CASE STUDY

Radio-guided occult lesion localisation using iodine 125 Seeds “ROLLIS” to guide surgical removal of an impalpable posterior chest wall melanoma metastasis

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Abstract
Cancer screening and surveillance programmes and the use of sophisticated imaging tools such as positron emission tomography-computed tomography (PET-CT) have increased the detection of impalpable lesions requiring imaging guidance for excision. A new technique involves intra-lesional insertion of a low-activity iodine-125 (125I) seed and detection of the radioactive signal in theatre using a hand-held gamma probe to guide surgery. Whilst several studies describe using this method to guide the removal of impalpable breast lesions, only a handful of publications report its use to guide excision of lesions outside the breast. We describe a case in which radio-guided occult lesion localisation using an iodine 125 seed was used to guide excision of an impalpable posterior chest wall metastasis detected on PET-CT.

Introduction
Methods to guide excision of impalpable lesions include hook-wire insertion (HWL), intra-operative ultrasound (IOUS) and radio-guided occult lesion localisation (ROLL) using the injection of 99mTc-labelled colloidal human serum albumin.1 A new technique, ROLL using 125I Seeds (ROLLIS) offers many advantages2 as illustrated in this report. Written permission was obtained from the patient to use their information for this publication.

Case Report
A surveillance F-18 fludeoxyglucose positron emission tomography/computed tomography (FDG PET/CT) scan in a 59-year-old female with a history of metastatic melanoma showed intense uptake within a 3 x 4 mm subcutaneous nodule on the left posterior chest wall (Fig. 1A and B). A previous history of excision of metastatic deposits elsewhere was noted. Clinical exam was normal. Ultrasound (US) showed an oval-shaped well defined hypoechoic vascular mass (Fig. 2).

On the morning of surgery an 125I seed (~2 MBq) was inserted using US (Fig. 3A, B and C). In theatre, the surgeon used a hand-held gamma probe, set to detect the energy from the 27 keV photon emitted by the 125I seed to locate and remove the lesion. Successful removal of seed and lesion was confirmed by absent radioactive counts in the wound, high counts within the specimen and visualisation of the lesion and seed on X-ray...
Following tissue fixation, a further grid specimen radiograph (Fig. 4B) demonstrated lesion and seed co-ordinates for the pathologist. Histopathology showed a 6 mm melanoma deposit with negative tumour margins. A follow-up F-18 FDG PET/CT scan showed only faint uptake in the surgical bed consistent with post-operative change (Fig. 5A and B).

**Discussion**

In parallel with the increasing detection of impalpable breast lesions with screening mammography, the development and increasing use of sophisticated imaging techniques (such as F-18 FDG PET/CT) has led to earlier detection of small lesions in other parts of the body, some of which require pre-operative image-guided localisation for excision. Various methods of doing this have been described, including the use of HWL of pulmonary nodules, musculoskeletal, retroperitoneal and liver lesions\(^3\)–\(^6\) and ROLL to mark recurrent renal cell carcinoma, papillary carcinoma of the thyroid, retroperitoneal sarcoma, lesions of the popliteal fossa and recurrent thigh rhabdomyosarcoma.\(^7\)

In general, HWL is the most commonly used technique but has been associated with complications including movement of the wire after insertion and wire transection during surgery.\(^8\) Because the wire extends outside the skin, the localisation procedure must be performed on the day of surgery. This makes the surgical and radiology lists interdependent with delays or cancellations in either department inevitably reducing efficient use of resources. For lesions in difficult locations (such as in our patient) the presence of a hook-wire may also be physically awkward and uncomfortable.

Intra-operative ultrasound is being increasingly used by surgeons to guide lesion removal. The great advantages are that this eliminates the need for a separate pre-operative localisation procedure, does not expose the patient or staff to ionising radiation and gives real-time three-dimensional feedback during surgery. However, to use IOUS the lesion must be sonographically visible and US equipment and a suitably trained surgeon available.
Radio-guided techniques such as ROLL have been effectively used for breast and non-breast lesions. As with the use of hook-wires, however, the insertion procedure must be performed within 24 h of surgery due to the short half-life of $^{99m}$Tc (6 h). The inherently non-radio-opaque nature of $^{99m}$Tc labelled colloids also means that confirming accuracy of placement of the injection is difficult unless a contrast agent or marker clip is also used.

$^{125}$I seeds are radiopaque 4.5 × 0.8 mm titanium cylinders containing approximately 2 MBq of iodine-125 adsorbed onto a silver wire. Because they are solid and radiopaque, accuracy of placement can easily be confirmed using US, X-ray or CT. Experience with ROLLIS to localise impalpable breast lesions has shown that $^{125}$I seeds rarely migrate. The seed acts as a point source of radio-activity, giving precise real-time feedback as to the location of the lesion in three dimensions. All of this helps to make surgery easier.

$^{125}$I has a physical half-life of 60.14 days, which means the seed can be inserted several days (and in the case of patients undergoing neoadjuvant chemotherapy many months) before surgery. This has been shown to improve the utilisation of radiology resources, and patient convenience. The radiation exposure to patient, family and staff from the use of $^{125}$I seeds is minimal however the seed is a regulated sealed source of radioactivity, therefore its whereabouts must always be tracked. To minimise the risk of seed loss, good multidisciplinary communication and a seed handling protocol are essential.

Whilst there are meta-analyses evaluating the use of $^{125}$I seeds to localise breast lesions, there are only a few reports describing the use of this technique outside the breast. Fleming et al. used ROLLIS to localise a cluster of in-transit melanoma nodules in the lower leg of a 73-year-old man and Grotz et al. used it in eight patients; two with in-transit melanoma metastases. Straver et al. used seeds to mark malignant axillary nodes prior to neoadjuvant chemotherapy, and Jackson et al. to localise a PET-positive node in a patient with an unknown primary. The use of $^{125}$I seeds to guide excision of pulmonary nodules has also been trialled.

In conclusion, this case report provides another example of the successful use of ROLLIS as a relatively simple and accurate method to guide the excision of an impalpable lesion, other than in the management of breast cancer.
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**Conflict of Interest**

The authors declare no conflict of interest.

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