

Technical Note  
Head and Neck Oncology

# Current applications of ultrasound-guided wire localization in head and neck surgery

E. Samara<sup>1</sup>, M. Williams<sup>1</sup>,  
D. C. Howlett<sup>2</sup>

<sup>1</sup>Maxillofacial Department, Eastbourne District General Hospital, Eastbourne, East Sussex, UK; <sup>2</sup>Radiology Department, Eastbourne District General Hospital, Eastbourne, East Sussex, UK

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**Abstract.** Ultrasound-guided wire localization (USGWL) was originally developed for the removal of impalpable breast lesions. More recently, USGWL has been described in head and neck surgical practice and it has a number of applications in this field, with the potential to guide surgical exploration and the benefits of reducing operative time and morbidity. This technical note describes the use of preoperative USGWL to facilitate the removal of an impalpable neck node. A review of the current literature relating to the present applications of this technique in head and neck surgery is reported, highlighting its advantages and disadvantages.

Key words: ultrasound; ultrasound-guided; wire localization; head; neck; surgery; lesions.

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The use of ultrasound-guided wire localization (USGWL), or ultrasound needle localization, has only recently been described in head and neck surgery<sup>1</sup>, but its role in this field is increasingly recognized, with the benefits of decreased operative time and morbidity, as well as reduced trauma to the surrounding tissues due to the minimally invasive nature of the technique<sup>2</sup>. Successful utilization of USGWL has been reported for both benign and malignant lesions in the neck<sup>2–4</sup>. In this region, the technique has predominantly been used preoperatively with only two reported cases of intraoperative use<sup>4</sup>. USGWL in the neck is usually performed

by a radiologist with experience in head and neck ultrasound, either in the ultrasound department or in theatre pre- or intraoperatively.

This technical note presents a case of USGWL to facilitate the surgical excision of an impalpable neck node. A review of the technique of USGWL and a discussion of its current and potential applications in head and neck surgery is also presented. The literature review was conducted up to March 2018 using the key words “ultrasound-guided wire localization”; “ultrasound-guided needle localization”; “head and neck surgery”; and “impalpable lesions”. The PubMed; MEDLINE; and

Embase databases were searched. Only articles published in English involving human participants were included.

## Technique

A 57-year-old woman with a history of non-Hodgkin lymphoma and with impalpable suspicious nodes found on ultrasound of the right neck at level 3 (Fig. 1a), underwent an ultrasound-guided core biopsy with equivocal findings; histology suggested possible reactive change/disease recurrence. USGWL was performed to allow excision of the node in question for definitive histological

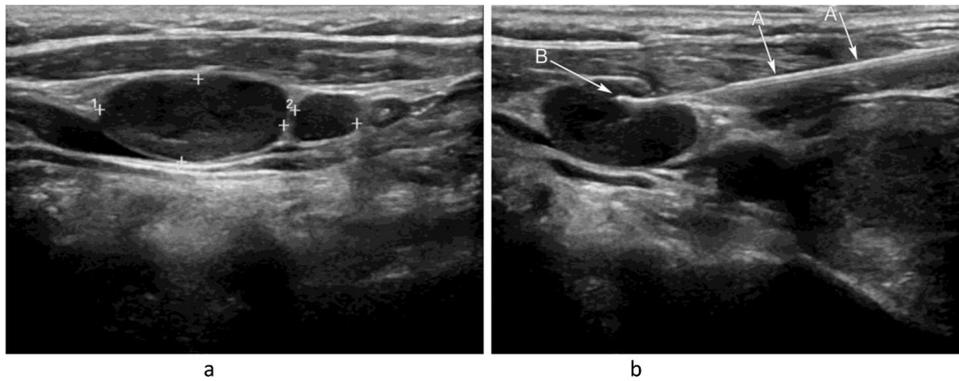


Fig. 1. (a) Longitudinal sonography demonstrating atypical nodes in the right neck at level 3, absent hila, and a heterogeneous texture. (b) The tip of the localization wire (B) has been extruded from the needle (A) and deployed adjacent to the node capsule.

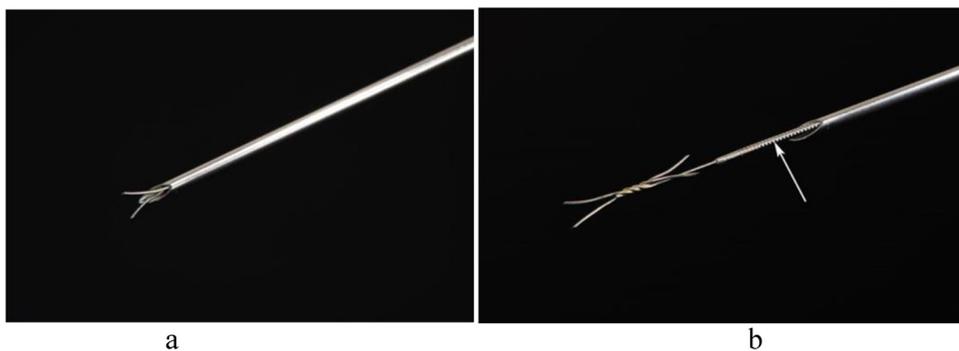


Fig. 2. (a) The tip of the 19.5-gauge localization needle in magnification: the central wire/hook lies within the needle, with the tip of the hook wire partially extruded. (b) The ultrasound localization wire: the hook wire is extruded from the bevelled needle tip allowing self-expansion of the distal hook. There is thickening of the distal wire (arrow) that facilitates the deployment of the hook wire in the lesion and allows intraoperative manipulation.

assessment. The localization wire was passed horizontally with the ultrasound beam and the hook was deployed just adjacent to the node capsule (Fig. 1b). The node was successfully removed by the operating surgeon. Surgical histology confirmed reactive hyperplasia.

With this technique, the lesion is identified preoperatively using a high-resolution linear array ultrasound transducer. The access point of the needle/wire is marked on the skin, and this can be done in consultation with the operating surgeon. The area is cleaned and draped as part of the aseptic technique. Access to the lesion is carefully assessed sonographically to avoid adjacent structures and also to align with the planned route of the surgical approach. The transducer is covered with a sterile probe cover and sterile coupling gel is used<sup>4</sup>. Local anaesthetic is required because of the size of the needle. This should be administered with caution adjacent to the lesion, as small lesions can be obscured by the local anaesthetic fluid<sup>4</sup>. A small incision is made in the skin for passage of the needle. Different lengths and diameters of needle can be used (the

most frequently used is 19.5-gauge and 9 cm long). The needle is inserted and directed using the ultrasound transducer. The needle and the needle tip appear echobright on ultrasound.

The needle has a bevelled tip and hollow core containing a central wire with a compressed self-expanding hook at the tip<sup>5</sup> (Fig. 2). The tip of the localization needle is deployed under ultrasound guidance either within or adjacent to the lesion. Once the position has been confirmed, the central wire is pushed gently and the hook on the wire tip springs open as it is extruded beyond the tip of the needle (Fig. 2b). The needle is then removed leaving the wire fixed in or in immediate proximity to the lesion. The hook wire deployment should be conducted carefully because the hook cannot be retracted after release (although needles with retractable hooks have recently been introduced). There is distal thickening of the wire near the hook, which allows manipulation of the wire and the lesion during surgical dissection (Fig. 2b).

To optimize needle visualization sonographically during insertion, the needle should ideally pass as near parallel to

the long axis of the ultrasound beam as possible (angulation towards or away from the beam can impair needle visualization and may impair precise deployment). The wire/wire tip can be deployed within the lesion, although sometimes the wire tip is positioned immediately adjacent to the lesion, as this can be beneficial in reducing distortion of the internal architecture for later histological examination (Fig. 1b). The approach used will depend upon the nature of the lesion, ease of access, and surgeon/operator preference. Once the hook wire is deployed, the needle is then carefully removed over the wire and the hook wire is secured or folded-back on the patient's skin. The wire may be fixed with a crocodile clip to prevent migration, although the hook wire itself should provide adequate fixation<sup>6</sup>. The skin overlying the lesion can also be marked, indicating its site relative to the skin marker. The depth of the wire from the skin surface can be recorded to help the surgical approach. If time allows, real-time scanning and direct discussion with the surgeon preoperatively can help with planning the approach and marking<sup>7</sup>.

Table 1. Uses of ultrasound-guided wire localization in the head and neck area.

Author	Area	Lesion	Intervention	Conclusion
Woodhouse et al. <sup>1</sup>	Multiple parotid oncocytoomas	Benign oncocytooma	Minimally invasive pre-auricular dissection undertaken with the wire deployed in the lesion preoperatively	The surgical access plane of the wire was marked, and surgical excision of the enlarging lesion confirmed benign disease
Bryant et al. <sup>2</sup>	Supraclavicular fossa	Impalpable deep lower cervical lymph node	Node detected during ultrasound examination was removed using USGWL	Simple, safe, and reliable procedure
Duprez et al. <sup>3</sup>	Thyroid	Patients with papillary thyroid carcinoma	Removal of recurrent lymph node metastases with USGWL	USGWL is more effective than neck dissection
Zimmerman et al. <sup>4</sup>	Thyroid	Medullary thyroid carcinoma recurrence with lymph node metastasis	Resection of thyroid carcinoma	The authors opted for this technique as the scar tissue makes identification of the lesion more difficult
Fletcher et al. <sup>5</sup>	Thyroid	Nodal recurrence of papillary thyroid cancer several years after total thyroidectomy and radioiodine treatment	A wire was placed under the surface of the paratracheal node under ultrasound guidance	The previous incision was used and focused dissection was performed directed by the guide-wire; the authors recommended this technique either combined with or as an alternative to the use of radiotracers
Park et al. <sup>6</sup>	Cervical area	Impalpable cervical masses in eight patients (six of them had undergone previous surgery in the area)	Preoperative ultrasound-guided hook wire insertion for non-palpable cervical masses	Effective means to locate and excise palpable lesions
Thomas et al. <sup>7</sup>	Infrahyoid region	Appendiceal carcinoid	Impalpable lymph node in the neck as confirmed on octreotide isotope scan	USGWL aided the successful excision of this benign lesion
Purayidathil et al. <sup>8</sup>	Suprahyoid region	Thyroglossal cyst	Cyst localized with the wire and removed via Sistrunk's procedure without complications	Successful removal using this technique and complete removal of symptoms
Rozen et al. <sup>9</sup>	Cervical area	Thyroid malignancy in patients who underwent thyroidectomy and radioiodine treatment	Three patients, found with enlarged lymph nodes sonographically, underwent USGWL	Nodal excision could improve outcomes of radioactive therapy and minimize the need for formal neck dissections
Breeze et al. <sup>10</sup>	Neck region, symptomatic palpable swelling	Branchial cyst	Excised with USGWL	Successful excision with no complications

USGWL, ultrasound-guided wire localization.

## Discussion

This technical note demonstrates the successful application of USGWL in facilitating the excision of an palpable lesion in the neck. The first use of the technique in the head and neck region was reported in 2004, for the removal of palpable cervical lymph nodes<sup>4</sup>. USGWL has a wide range of applications in head and neck surgical practice, as described in Table 1<sup>1-10</sup>, including the excision of branchial and thyroglossal cysts, cervical lymph nodes, and parotid lesions<sup>1,2,3,6,8,10</sup>. These cases demonstrate the variability in pathology and the wide range of potential applications in lesion localization<sup>7</sup>.

The advantages of USGWL include real-time visualization of the needle and wire deployment, aiding surgical access and reducing operating complication rates, operating time, and trauma to the area<sup>8</sup>. Moreover, it is particularly useful in previously operated areas or within radio-

therapy fields where the normal anatomy has been distorted. Careful patient selection is essential, with potential cases reviewed and discussed in a multidisciplinary format. It is important that both the radiologist and the operating surgeon understand the anatomical location of the lesion in question and the desired route of surgical access, which is necessary for planning needle/wire placement. Finally, close collaboration between radiologists and surgeons is essential for a successful outcome<sup>9</sup>.

USGWL is low cost, safe, and widely available. It allows real-time needle/wire placement and avoidance of the adjacent vascular structures. It is important to note that USGWL is operator-dependent, requiring ultrasound and needle guidance skills. Moreover, there is the potential for the wire to displace/migrate, although this has not been reported in the head and neck area. Finally, the procedure should be

performed as close to the time of operation as possible in order to reduce this likelihood<sup>6</sup>, and close liaison and discussion between surgeon and operator are essential to assure successful outcomes.

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## Competing interests

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## Ethical approval

Nothing to declare.

## Patient consent

Not required.

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Address:  
 E. Samara  
 Maxillofacial Department  
 Eastbourne District General Hospital  
 Kings Drive  
 Eastbourne  
 East Sussex  
 BN21 2UD  
 UK  
 E-mail: [elpida.samara@nhs.net](mailto:elpida.samara@nhs.net)