

R E V I E W

Percutaneous needle biopsy of retroperitoneal lesions: technical developments

Andrea Bevilacqua¹, Fabiano Vito D'Amuri¹, Francesco Pagnini¹, Vittorio Sabatino¹, Umberto Russo¹, Nicola Maggialetti², Pierpaolo Palumbo³, Silvia Pradella⁴, Andrea Giovagnoni⁵, Vittorio Miele⁴, Massimo De Filippo¹

¹Department of Medicine and Surgery, Unit of Radiologic Science, University of Parma, Maggiore Hospital, Parma, Italy; ²Department of Medicine and Health Sciences "V. Tiberio", University of Molise, Campobasso, Italy; ³Department of Biotechnology and Applied Clinical Sciences, University of L'Aquila, S. Salvatore Hospital, L'Aquila, Italy; ⁴Department of Radiology - Careggi University Hospital, Florence, Italy; ⁵Department of Radiology, Università Politecnica delle Marche, Ancona, Italy

Summary. Percutaneous Needle Biopsy (PNB) is the insertion of a needle into a suspected lesion or an organ with the aim to obtain cells or tissue for diagnosis. It's a relatively non-invasive procedure and is performed by radiologist under guidance of imaging techniques such as ultrasound (US), computed tomography (CT), fluoroscopy, magnetic resonance imaging (MRI), and positron emission tomography CT (PET-CT). The choice of imaging technique depends on the evaluation of the target lesion and patient compliance. PNB includes two categories: fine-needle aspiration biopsy (FNAB) that is the use of a thin needle (18-25 gauge) to extract cells for cytological evaluation; and core needle biopsy (CNB) that is the use of a larger needle (9-20 gauge) to extract a piece of tissue for histological evaluation. The indications for biopsy are the characterization of nature (benign or malignant) of a lesion, diagnosis and staging of tumor, and biological or immunohistochemical/genetic analysis on tissue. Success of PNB is the procurement of sufficient material to characterize lesions and to guide the patient outcome. Major complications are rare. PNB became a useful technique in diagnosis and study of retroperitoneal lesions, because of a more suitable access to specific intra-abdominal structures, lowering the risk of injury of interposed structures (such as bowel, great vessels). (www.actabiomedica.it)

Key words: biopsy, retroperitoneum, tumor, computed tomography

Introduction

Image-guided Percutaneous Needle Biopsy (PNB) is an interventional procedure performed by radiologists (1-5) with the aim to obtain cells or tissue for diagnosis by the insertion of a needle into a suspected lesion.

It's a relatively non-invasive procedure, and it has absolute advantages compared to open or excisional biopsy.

Success of PNB is related to proper patient selection, preparation and adequate procedural planning (6-8).

Planning and procedural phases

PNB implicates the involvement of interventional radiologists in multidisciplinary boards (9-21). The radiologist has a key role in the pre-procedural phase: to evaluate potential contraindications and risks of PNB, to confirm the indications for PNB and to identify the optimal target and the selection of the proper imaging guidance.

Indications to PNB are the characterization of nature (benign or malignant) of a lesion (22), the diagnosis and staging of a tumor, and biological or immunohistochemical/genetic analysis on tissue (7, 23).

Although PNB is a relatively non-invasive procedure, there are some contraindications, such as the alteration of coagulation status (specially if it can't be correctable) and bleeding risk, the patient's clinical status (to tolerate bleeding or anesthesia) and cooperation.

The main imaging-guide modalities are ultrasound (US) (24-26) and computed tomography (CT) (27-35); other uncommon imaging techniques are fluoroscopy, magnetic resonance imaging (MRI) (36-47), and positron emission tomography CT (PET-CT) (6, 7, 48).

US guidance has a wide use because of portability, lack of ionizing radiation, and low operating cost. Real time imaging allows to visualize and track the needle throughout its entire pathway and is useful even in lesions moving on respiratory motion; Color-Doppler (24) aid in vascular structures visualization. Furthermore, in selected patients, US contrast-injection increases lesion characterization on the surrounding tissue. Freehand or needle-guided technique are both suitable. Compared to the freehand technique, the guided technique is limited by a fixed angle. Limits of the US-guidance technique are the operator experience and the appropriate acoustic window view, such as the difficulty to penetrate air-filled structures and bone(49).

Compared to US, CT has a better preprocedural planning of PNB, because of its high spatial resolution and large field of view. It permits multiplanar reformations (MPR) to obtain a more adequate path of needle. An intravenous contrast injection may be required to increase accuracy on lesion visualization.

Other imaging guidance modalities are: CT-fluoroscopy, that allows a real-time visualization of the needle, advancement reducing procedural time, but it exposes operators and patients to radiation doses; MR-guidance, despite excellent soft tissue contrast and lack of ionizing radiation, isn't currently feasible because of increased costs and procedure time, the lack in appropriate open-scanner and MRI-compatible instruments;

PNB includes two basic techniques for sample acquisition: fine needle aspiration biopsy (FNAB) and core needle biopsy (CNB) (Figg. 1-6) (50, 51).

FNAB device extracts individual cells for cytological evaluation using a small needle (18-25G) with

inner stylet. Once in place, the stylet is removed, a syringe is attached to the needle, and cells are aspirated. Small lesions, necrotic tumors or lesions close to critical structures are its main targets. The most commonly devices used in retroperitoneal biopsies are the spinal needles and the Chiba needles (52).

CNB devices use larger needles (9-20G) with different mechanisms (manually or automatically cutting systems) to extract a piece of tissue for complete histologic evaluation (53).

A safe and proven technique is the use of coaxial needle: the biopsy needle is introduced coaxially into



Figure 1. A 72 years old man with history of total gastrectomy for ADK. CT-guided CNB on supine patient for histological evaluation of epigastric solid lesion



Figure 2. A 64 years old man with outcome of pulmonary lobectomy for primitive lung cancer. CT-guided CNB on prone position of retroperitoneal node: the sample permitted to confirm the metastatic nature

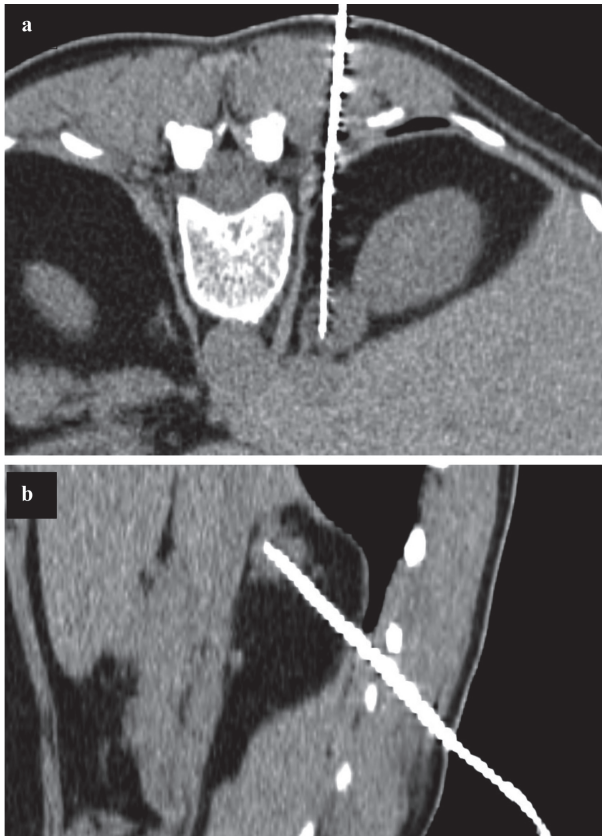


Figure 3. 54 years old woman with previous cervical and endometrial squamous cells carcinoma, with indeterminate right adrenal solid lesion having elevated metabolic activity at PET examination. CT guided CNB on prone position in axial view (a) and parasagittal reconstruction (b), permitted the histological diagnosis of adenoma



Figure 4. An 81 years old woman with outcome of anterior resection of the rectum for ADK with focal thickening of posterior wall. CT-guided FNAB on prone position of the lesion confirmed recurrence of the tumor

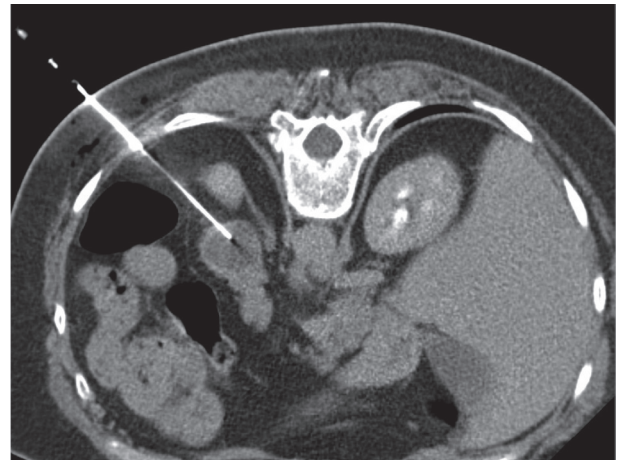


Figure 5. A 65 years old woman with abdominal pain; the abdominal CT demonstrate a pancreatic tail lesion. CT-guided PNB on prone position of pancreatic tail lesion showed a neuroendocrine tumor

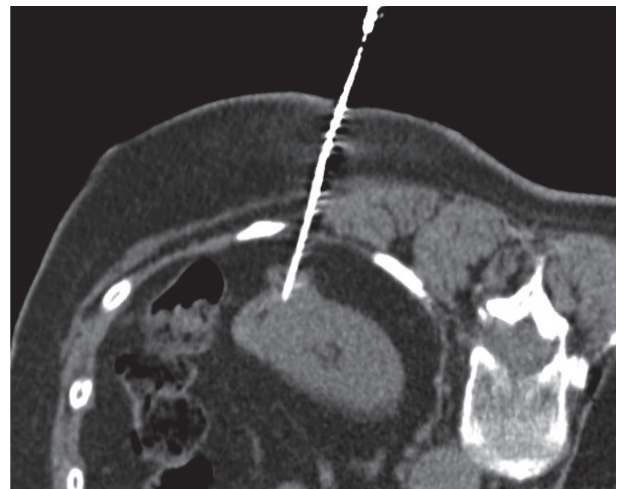


Figure 6. A 75 years old woman with solid exophytic lesion of left kidney. CT-guided CNB on prone position showed a renal cell carcinoma

a guide needle (9-19G), previously advanced nearby the target. It doesn't increase the recurrence of complications and allow multiple specimen samples in a single puncture and decrease the tumor cells seeding risk along the needle tract (48, 54-58).

The extracted samples are then smeared on glass slides and fixed (FNAB) or placed in formalin (CNB); for bacteriological analysis the sample is sent in saline for culture(59, 60).

Post-procedural phase

Retroperitoneal PNB is considered a minimally invasive and safe procedure.

There are major and minor complications, related to the technique (bleeding, infection, perforation, tract seeding) or to organ specific injury (such as haematuria, pneumothorax, haemoptysis, air embolism).

After the procedure and before discharge, imaging control is generally obtained and documented to detect immediate possible complications; equally, vital signs monitoring and clinical observation are required for a few hours following the procedure. In case of major complications, hospitalization in appropriate environment should be guaranteed.

Technical success of PNB varies greatly depending upon the size and location of the target, benign or malignant nature of the lesion, number of samples obtained, availability of an onsite cytopathologist, IRs' and pathologists' experience, equipment availability (61).

Clinical success of PNB is the usefulness of the procedure in terms of improvement of patient care.

In case of non-diagnostic biopsy a repeated biopsy should be considered, such as different techniques or approaches modalities (surgical biopsy or open access) (62-67).

Conclusions

Retroperitoneal Percutaneous Needle Biopsy is a minimally invasive, well established and safe procedure, with a low rate of complications and high diagnostic yield.

Radiologist plays a critical role in the entire management of the patient, since the procedure planning until the patient discharge.

PNB is gaining an even more crucial role, specially with the development of molecular personalized treatment, so avoiding in several patients more invasive diagnostic procedure.

Ethical approval: This article does not contain any studies with human participants performed by any of the authors.

Conflict of interest: None to declare

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Correspondence:

Pagnini Francesco,

Department of Medicine and Surgery,

Unit of Radiologic Science, University of Parma,

Maggiore Hospital, Via Gramsci 14 - Parma, Italy

E-mail: f.pagnini90@gmail.com