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● *Review*

ULTRASOUND-GUIDED PERCUTANEOUS CORE NEEDLE BIOPSY FOR THE DIAGNOSIS OF PANCREATIC DISEASE

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Abstract—Few studies have evaluated the performance of percutaneous core needle biopsies of the pancreas. This article is an overview of the advantages, disadvantages, predictive power and complications associated with percutaneous ultrasound-guided core needle biopsies of pancreatic lesions. A comprehensive literature search of Medline (using PubMed as the search engine) and EMBASE was done to identify suitable studies up to March 2017. A study of quantitative pre-operative pancreatic biopsy data was reported. Lesion location, mean or median number of passes, inadequate tissue or technical failures and complications were assessed for all cases by reviewing clinical notes and post-procedural imaging. The analysis included 13 studies, mostly of a retrospective nature. The sensitivity (mean: 94.42%, range: 90%–100%) and specificity (mean: 97.94%, range: 94.7%–100%) of the procedure were high, and the mean accuracy of diagnosis was 95.76 (range: 91–100). Furthermore, the procedure had a high negative predictive value of approximately 76.26%. Of the 13 reported studies, 7.3% were inadequate or technical failure cases. The mean rate of complications was 2.08%, which seemed similar to the lower limit of this rate for endoscopic ultrasound-guided fine-needle aspirations. The risk of tumor seeding with ultrasound-guided core needle biopsies was not reported in the included articles. With the development of technology, ultrasound-guided percutaneous core needle biopsy for pancreatic lesions is increasingly available and has optimal diagnostic power in pancreatic neoplasms. (E-mail: huangying712@163.com)

Key Words: **Biopsy, Large-core needle, Pancreatic, Percutaneous, Ultrasonography, Interventional.**

INTRODUCTION

Pancreatic cancer is a fatal disease with a poor prognosis, which is due partly to delayed diagnosis because of the late onset of symptoms (Jemal et al. 2009). So early detection and accurate staging are vital in choosing the appropriate treatment.

Solid pancreatic lesions detected by imaging examinations include cancer, focal pancreatitis, tuberculosis, lymphoma and metastases. However, some of these lesions cannot be easily distinguished by laboratory testing and imaging (Neff et al. 1984; Podolsky et al. 1981). Even so, pre-operative staging must provide reliable information on the extent of the cancer. In this case, pancreatic biopsy is often required for initial diagnosis of pancreatic masses before chemotherapy or radiotherapy (Hartwig et al. 2009; Itani et al. 1997).

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Biopsy can be performed intra-operatively (Ingram et al. 1978; Moossa and Altorki 1983), endosonographically (Brugge and Van Dam 1999) or percutaneously under computed tomography (CT) (Harter et al. 1983) or ultrasonography (US) guidance, respectively (Hancke et al. 1975; Mitchell et al. 1989). US-guided percutaneous biopsy is often used and is suitable for the diagnosis of pancreatic pathology or the rejection of pancreatic allograft for four reasons (Atwell et al. 2004). First, on sonography, real-time imaging and multiplanar monitoring are displayed as the biopsy needle traverse tissues along the path to the lesion. Second, the high spatial resolution of US imaging has led to its ever-increasing use in pancreatic interventional procedures. Third, compared with endoscopic ultrasound (EUS), percutaneous US scanning can reveal a wider observed area in a single view without gas interference. Similarly, EUS-guided biopsies may not be suitable for lesions in the body (Kahriman et al. 2016), tail or deep regions of the pancreas (Hartwig et al. 2009), which are inaccessible with the high-frequency probe and cannot be evaluated (Wei et al. 2015). Fourth, unlike CT, which is time consuming and exposes both patients and radiologists

to significantly increased radiation doses, US may be more convenient and its widespread adoption not limited.

On the other hand, tissue acquisition is important in confirming the diagnosis and guiding the treatment of a pancreatic mass. Despite its extensive use, fine-needle aspiration (FNA) is limited because it only provides a cytologic specimen with few histologic structures, which prevents a complete tissue analysis for diagnosis and classification (Hebert-Magee 2015). Another limitation of FNA is the uncertain number of passes required to acquire sufficient sample without a standby cytopathologist (Kedia et al. 2013). A core needle biopsy (CNB) specimen can theoretically overcome FNA-related limitations and have higher diagnostic accuracy, because it provides well-preserved tissue structure for histologic evaluation.

Percutaneous CNBs have been performed since 1980; however, few studies have evaluated their performance. In addition, there exists a dilemma in that the potential complications of percutaneous biopsy such as hemorrhage, pancreatitis, tumor seeding and fistulas outweigh its potential benefits. This relative paucity of data makes it difficult to compare CNB results directly with the results of EUS-guided biopsy.

What follows is a review of the advantages, disadvantages, predictive power and complications related to percutaneous US-guided CNB of pancreatic lesions.

SEARCH STRATEGY AND STUDY SELECTION

A comprehensive literature search of Medline (using PubMed as the search engine) and EMBASE was done to identify suitable studies up to March 2017. The search was based on the following combinations of Medical Subject Heading terms, EMtree terms and text words and was restricted to English publications: "biopsy" AND ("ultrasonography" or "ultrasonics" or "ultrasound" or "echography") AND ("pancreas" or "pancreatic") AND "percutaneous." The bibliographies of retrieved articles were searched manually to identify relevant studies.

Study selection

All stages of study selection and data abstraction were conducted independently by two reviewers (Y.H. and J.S.). Search findings were screened for potentially qualified studies. Abstracts and full articles were obtained for detailed evaluation; qualified trials were included.

Data extraction

The search initially identified 282 potential titles and abstracts; of these, 192 irrelevant citations were excluded after an initial review of titles, and the remaining 90 references were retrieved as full-text articles for further assessment. An additional 56 had to be excluded by abstract review for a variety of reasons. Two records were included by manual search references or by use of the related articles function in PubMed. Twenty-three studies were excluded after in-depth review, leaving 13 studies that fulfilled the criteria for inclusion (Fig. 1).

Four studies evaluated the diagnostic accuracy of percutaneous US-guided core needle biopsy of pancreatic masses (Bhatti et al. 2016; Kahriman et al. 2016; Mitchell et al. 1989; Yang et al. 2015). One of the four studies directly compared the tolerability and efficacy of US-guided core biopsy versus FNA (Yang et al. 2015). One study evaluated percutaneous biopsy of the pancreas under contrast-enhanced ultrasound (CEUS) guidance (Wei et al. 2015). Eight studies provided data on percutaneous US-guided biopsy of pancreas allograft (Atwell et al. 2004; Gaber et al. 1992; Klassen et al. 2002; Kuo et al. 1997; Lee et al. 2000; Malek et al. 2005; Stephens et al. 2012; Wong et al. 1996).

Quantitative data on the respective sensitivity, specificity, negative predictive value and accuracy were extracted from five primary studies. Date of publication, country of origin, prospective or retrospective design, number of centers, length of study, age, gender, needle types and sample size were tabulated systematically (Table 1). Further information extracted from each article included lesion location, mean or median number of passes, inadequate tissue or technical failures and complications for all cases.

All included studies were published between 1989 and 2016. The samples analyzed contained 12 to 250 participants. Two trials were prospective, randomized comparisons. The remaining studies were based on predominantly retrospective analyses of prospectively collected data or on retrospective identification of biopsy samples of patients who underwent biopsy. All reports contained results of single-center series.

US-GUIDED PERCUTANEOUS PANCREATIC BIOPSY TECHNIQUES

Compared with CT-guided biopsy (Lee et al. 1998), in US-guided percutaneous biopsy, the insertion points in the skin through which the pancreas is accessed can be chosen more freely, either sagittally or transversely. To avoid damage to important structures, such as the gallbladder and hepatic and gastroduodenal arteries, the ideal insertion point, especially for diagnostic purposes, is the left upper quadrant, left of the midline. Manual compression is often applied to the abdominal wall to avoid needle access into hollow organs. Transgastric passage is commonly used; transcolonic passage should be avoided. However, the insertion points for other therapeutic interventional aims should be chosen based on the location of each individual lesion.

Two types of probes are used for interventional procedures: those with lateral support and those with