CT-Guided Core Needle Biopsy of Deep Suprahyoid Head and Neck Lesions in Untreated Patients

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Summary

This study aimed to evaluate the efficacy of CT-guided core needle biopsy (CNB) in the diagnosis of deep head and neck tumors in untreated patients.

We retrospectively reviewed the records of ten consecutive CT-guided CNB procedures from ten patients without a related history from March 2004 to February 2012. The surgical results, treatment response and clinical follow-up were used as the diagnostic standards. All specimens were considered adequate. Nine out of ten cases matched the final diagnosis. Biopsy failed to diagnose the infratemporal meningioma en plaque in a particular case. Three cases were carcinomas. No complication was encountered.

CT-guided core needle biopsy is an efficient and safe technique for histological diagnosis of skull base lesions in patients without a related history. This technique can offer a definite tissue diagnosis and avoid unnecessary surgical interventions for such patients.

ance can thus be used for these cases. CT-guided fine needle aspiration (FNA) is reportedly effective in diagnosing head and neck lesions⁴, but it can be biased by the specimen quality⁵. Alternatively, CT-guided core needle biopsy (CNB) can also be used in this special field⁶. Using CT guidance, the biopsy needle can reach the target area, obtaining an optimal specimen and contributing to histopathological evaluation.

Few studies have demonstrated the results of CT-guided CNB in diagnosing head and neck lesions. A large proportion of the reported patients were those with treated head and neck lesions^{7,8}. Prior surgery or treatment to these lesions can alter the original anatomic structures, thus posing a bias to the efficacy of the biopsy. There is no specific article discussing the outcome and efficacy of this technique in patients without a related history or treatment. Here, we present the results of CT-guided CNB of deep suprahyoid head and neck lesions in ten patients.

Introduction

Deep head and neck lesions, especially those in the skull base, are usually clinically inaccessible. Surgical biopsy of these lesions can be challenging with notable risk. Generally, ultrasound (US)-guided needle biopsy is effective for superficial head and neck lesions^{1,2}. However, there is a limited acoustic window for visualization of the deeper head and neck area due to intervening osseous and air-containing structures³. Computed tomography (CT) guid-

Material and Methods

We retrospectively reviewed the chart records of the ten consecutive CT-guided core needle biopsies of deep suprahyoid head and neck lesions from ten patients (three female, seven male, age range 29–76 years; mean, 49.3 years) who had no related history from March 2004 to February 2012. Four radiologists performed the procedures. All records reviewed were approved by the institutional research board of our institute.

Figure 1 A 56-year-old man (case 9) with a right parapharyngeal lesion. A) Non-enhanced CT shows an ill-defined lesion in the right parapharyngeal space (arrow). B) Using the paramaxillary approach, the biopsy needle (arrow) set was inserted to the lesion (arrow). Biopsy revealed an inflammatory process. Follow-up imaging studies in three months showed stationary status.

Figure 2 A 76-year-old man (case 4) with a right infratemporal fossa lesion. A) Pre-procedural CT shows an infiltrative lesion (arrow) in the right infratemporal fossa, carpeting around the sphenoid ridge. B) Using the subzygomatic approach, the biopsy needles (arrow) were inserted. The biopsy showed only fibrosis. Diploic meningioma was diagnosed by surgical result.

Before each biopsy, the diagnostic images including CT or magnetic resonance imaging (MRI) were reviewed to assess the lesion. The deep suprahyoid lesions were defined as lesions in the deep suprahyoid area, including the masticator space, parapharyngeal space, carotid space, deep parotid space, and retropharyngeal space. The anatomical structure in relation to the target lesions was scrutinized to conduct the needle pathway to avoid injuring the vital structures. Routine blood tests, including international normal ratio (INR), prothrombin time, partial thromboplastin time, hematocrit, and platelet counts were required prior to the biopsy. The need for and risk of the procedures were explained to each patient and his/her family. Informed consent was obtained.

The biopsies were performed with two CT scanners: a GE High Speed Advantage scanner (General Electric Medical Systems, Milwaukee, WI, USA) or a Siemens CT Volume Zoom scanner (Siemens Medical Systems, Erlangen, Germany). During the procedure, patients were positioned in a supine or lateral decubitus position. When necessary, the patient's head was tilted away from the lesion side to facilitate the needle approach. Gantry angulation was ad-

justed in axial CT scanning to determine the optimal entry site of the biopsy needle³. Intravenous contrast material was administered in all patients to enhance the vascular structures in the planned needle path. Local anesthesia with an appropriate amount of 1% lidocaine was used in all patients. None of the cases received general anesthesia.

The coaxial needle technique was used in all procedures, allowing multiple tissue samplings from one puncture. Four types of needle approaches, including subzygomatic, paramaxillary, retromandibular, and submastoid approaches, were used, determined by anatomical and technical considerations³. Using CT guidance, a 17 or 19 gauge co-axial needle (10 or 15 cm, respectively; Temno Biopsy Systems, Cardinal Health, Dublin, OH, USA) was inserted into the lesion. An 18 or 20 gauge semi-automatic core biopsy needle (15 cm or 20 cm; Temno Tru-cut Biopsy Systems) was then advanced through the introducer needle to the target lesion. Generally, two or three tissue cores were obtained. The specimen was preserved in a standard formalin solution and sent for histopathologic study (Figure 1).

In total, seven patients underwent CNB in an

outpatient service. These patients were observed for two hours after the procedure to ensure their stable condition. An 18 gauge biopsy needle (with a 17 gauge co-axial needle) was used in four procedures, and a 20 gauge needle (with a 19 gauge coaxial needle) was used for six procedures. The number of tissue cores obtained per patient ranged from one to three (mean, 2).

Specimen quality and adequacy were assessed by the pathologists. Specimens were considered adequate if they yielded material sufficient for histological analysis. The analysis of the diagnostic accuracy was performed by including all biopsy results and comparing those with surgical pathology, treatment response, and clinical follow-up as available⁷. Biopsies were considered incorrect if they mismatched the results from the surgical pathology, treatment response, or clinical follow-up course. Inadequate specimens or indeterminate biopsies were considered incorrect.

Results

The procedure details and results are summarized in Table 1. All patients were clinically followed for 12~48 months (mean 32 months). Three patients underwent surgery after the biopsy. The other seven cases were followed clinically. The lesion dimensions ranged from 2.0 to 5.7 cm (mean 2.8 cm). The subzygomatic approach was most frequently used ($n = 4$), followed by the retromandibular approach ($n = 3$).

All obtained specimens were considered adequate. The diagnostic accuracy was calculated for all biopsies in ten patients (cases 4, 5, 8 based on the surgical result, case 2, 6, 10 based on the treatment response, case 1, 3, 7, 9 based on the follow-up course).

In all, nine cases were correctly diagnosed by the biopsies. A specimen from an infiltrative lesion involving the right infratemporal fossa and sphenoid ridge showed fibrosis and chronic inflammation. The surgical result showed meningioma en plaque. Sampling error and inaccurate diagnosis were considered (Figure 2, case 5).

Two cases were squamous cell carcinomas and one was undifferentiated carcinoma; all were diagnosed as nasopharyngeal carcinomas and treated with radiotherapy. The other seven cases were benign lesions. No complication was encountered in any case.

Discussion

Biopsies of superficial head and neck lesions are generally advocated for ultrasonographic guidance. However, ultrasonography is of little use for deeper lesions due to its limited acoustic window. CT guidance is more suitable for deep head and neck lesions, as it can provide better image assessment of the lesion through the intervening osseous and air-containing structures³. CT-guided FNA is relatively reliable for head and neck lesions with optimal diagnostic value, though potentially biased by specimen quality⁴. Generally, the specimen derived via FNA can contribute to cytology, but not readily for histopathology or further study. CT-guided CNB is an alternative method for the diagnosis of deep head and neck lesions by retrieving an adequate, high-quality specimen. Percutaneous biopsies of head and neck lesions are usually performed with the coaxial needle technique which allows multiple tissue samplings without additional needle passes. In addition, by using the coaxial needle technique, the CNB can incorporate with FNA, enhancing the diagnostic quality in tissue diagnosis of the head and neck area⁹.

For patients with lesions in deep head and neck areas, it is important to differentiate malignancy from a benign process before initiating a proper treatment. Needle biopsy of such lesions plays a crucial role, as surgical biopsy may not be feasible in consideration of procedural risk. Our results showed a good diagnostic result of CT-guided CNB for such patients. Surgical biopsy can thus be avoided in these patients. Our results are similar to those reported in a study on the CNB of general skull base and deep facial lesions in patients both with and without a related history⁷. However, previous treatment or surgery could exert more bias on the diagnostic efficacy of the following biopsies. Our study included patients without a related history or treatment and thus presented the diagnostic value of CT-guided CNB for such patients.

Several needle approach methods have been used for CT-guided needle biopsy of head and neck lesions^{3,10}. The subzygomatic route was adopted in most of our cases. Generally, the subzygomatic approach is suited for the biopsy of lesions in the masticator, parapharyngeal, and retropharyngeal spaces. Technically, using a subzygomatic approach, the biopsy needle may pass through the pterygoid venous plexus,

Table 1 Clinical profile, biopsy details, and follow-up of the core needle biopsies.

Case	Age	Gender	Location	Lesion size (cm)	Lesion depth (cm)*	Biopsy / coaxial needle size (G)	Needle Approach	No. of needle passes	Diagnosis	Treatment or follow-up course
1	31	F	CS	3,5	2,4	17/18	Retromandibular	1	Paraganglioma	No change at 1-year f/u.
2	42	M	MS	3,0	3	17/18	Retromandibular	2	Undifferentiated carcinoma	Treated as NPC with radiotherapy. Lesion regression at 6-month f/u.
3	29	M	MS	2,0	2,9	19/20	Subzygomatic	3	Fibrosis	No change at 1.5-year f/u.
4	76	M	MS	2,5	3,7	17/18	Subzygomatic	2	Fibrosis	OP: Rt sphenoid ridge meningioma; sampling error considered. (Figure 2)
5	34	M	PPS	2,5	6,8	19/20	Subzygomatic	2	Fibrosis	OP: skull base fibrosis. No change at 3-year f/u.
6	53	M	RP	2,5	6	19/20	Paramaxillary	2	SCC	Treated as NPC with radiotherapy. Lesion regression at 6-month f/u.
7	52	F	Rt PPS	2,0	4	19/20	Retromandibular	1	Pleomorphic adenoma	No change at 1-year f/u.
8	64	F	MS	3,0	4	19/20	Subzygomatic	3	Inflammation	OP: local inflammation. Regression at 6-month f/u.
9	56	M	PPS	5,7	5,6	19/20	Paramaxillary	3	Inflammation	No change at 6-month f/u. (Figure 1)
10	56	M	PPS	4,8	2,5	17/18	Submastoid	1	SCC	Treated as NPC with radiotherapy. Lesion regression at 6-month f/u.

CS = carotid space. MS = masticator space. RP: retropharyngeal space. SCC = squamous cell carcinoma. NPC = nasopharyngeal carcinoma. OP = surgical intervention. *Lesion depth = the depth of the lesion measured from the entry site along the path of the guidance needle.

but no such needle-related injury was reported. The retromandibular approach was used in three of our patients. This approach is particularly useful for relatively deep lesions, such those in the retropharyngeal space and prevertebral space. Based on our experience, selection of the needle approach depends on the

lesion location and individual anatomic relations.

There was one case (case no. 4) in which CT-guided CNB failed to match the corresponding diagnosis in our study. In this particular case, an infiltrative lesion involving the right infratemporal fossa, orbital apex, and middle cranial

fossa was found in pre-procedural CT (Figure 2). The biopsy with an 18G needle yielded only fibrosis. Surgical specimens of the lesion revealed meningioma en plaque. This uncommon type of meningioma features limited tumor thickness, most commonly involving the sphenoid ridge, and usually associated with hyperostosis of the skull involved¹¹. In our case, the specimen yielded fibrosis, which may due to peri-tumoral reactive changes. Thus, in such a case, MRI might be necessary before CNB for better delineation of the tumor. Tissue sampling of the lesion can be more accurate by placing the biopsy needle well within the tumor.

No complication was encountered in our patients after biopsies. CT-guided CNB is reportedly safe for tissue diagnosis of deep head and neck lesions^{3,7}, although some minor complications, including pain, vasovagal reaction, minor infection, and minor bleeding were reported. In a report of 17 patients who underwent CT-

guided CNB for deep face and skull base lesions⁷, no immediate or delayed procedural complication was encountered. Walker et al. reported a case with internal maxillary artery pseudoaneurysm formation three months after CNB in the masticator space.

Our study was limited by its retrospective nature and limited case number as ultrasound guidance is the primary tool for tissue diagnosis of head and neck lesions. Diagnostic confirmation in patients without surgery can also lack reliability, since the follow-up periods varied between cases.

In conclusion, CT-guided core needle biopsy is an effective and safe procedure for tissue diagnosis of deep suprahyoid head and neck lesions in untreated patients. Sampling errors may be encountered in ill-defined lesions in this group of patients. This technique can offer a definitive tissue diagnosis and avoid unnecessary surgical interventions for lesions in this special field.

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