• *CLINICAL RESEARCH* •

Value of CT-guided core-needle biopsy in diagnosis and classification of malignant lymphomas using automated biopsy gun

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Received: 2004-12-02   Accepted: 2005-02-18

Abstract

AIM: To evaluate the value of CT-guided core-needle biopsy in diagnosis and classification of malignant lymphomas.

METHODS: From January 1999 to October 2004, CT-guided core-needle biopsies were performed in 80 patients with suspected malignant lymphoma. Biopsies were performed with an 18-20 G biopsy-cut (CR Bard, Inc., Covington, GA, USA) needle driven by a spring-loaded Bard biopsy gun.

RESULTS: A definite diagnosis and accurate histological subtype were obtained in 61 patients with a success rate of 76.25% (61/80). Surgical sampling was performed in 19 patients (23.75%) with non-diagnostic core-needle biopsies. The success rate of CT-guided core-needle biopsy varied with the histopathologic subtypes in our group. The relatively high success rates of core-needle biopsy were noted in diffuse large B-cell non-Hodgkin's lymphoma (NHL, 88.89%) and peripheral T-cell NHL (90%). However, the success rates were relatively low in anaplastic large cell (T/null cell) lymphoma (ALCL, 44.44%) and Hodgkin's disease (HD, 28.57%) in our group.

CONCLUSION: CT-guided core-needle biopsy is a reliable means of diagnosing and classifying malignant lymphomas, and can be widely applied in the management of patients with suspected malignant lymphoma.

Li L, Wu QL, Liu LZ, Mo YX, Xie CM, Zheng L, Chen L, Wu PH. Value of CT-guided core-needle biopsy in diagnosis and classification of malignant lymphomas using automated biopsy gun. *World J Gastroenterol* 2005; 11(31): 4843-4847
http://www.wjgnet.com/1007-9327/11/4843.asp

INTRODUCTION

CT-guided percutaneous needle biopsy has become an important diagnostic tool and can minimize the need for open biopsy[1,2]. However, satisfactory sampling is essential for the diagnosis and classification of malignant lymphoma[3-5]. Percutaneous core-needle biopsy under the guidance of CT or ultrasound in evaluation of malignant lymphomas has a limited value[6-8]. The advantage of CT guidance is that the whole mediastinum or abdomen is visualized, allowing accurate planning of biopsy for deep and small lesions and avoiding damage to important organs and greater vessels[9,10]. In recent years, with the advance in new needle biopsy systems and technology of needle biopsy[11,12], CT-guided core-needle biopsy is widely used in the diagnosis and classification of malignant lymphoma[13,14]. Since 1999, CT-guided core-needle biopsy has been used as one of the routine sampling techniques for malignant lymphomas in our hospital. This study aimed to retrospectively evaluate the reliability of CT-guided core-needle biopsy for the diagnosis and classification of malignant lymphoma using an automated biopsy gun.

MATERIALS AND METHODS

Patients

From January 1999 to October 2004, 80 patients (51 men, 29 women) with suspected malignant lymphomas underwent CT-guided core-needle biopsy. They aged from 2.8 to 72 years (mean age, 48.5 years). In our series, six patients (7.5%) had a history of malignant lymphoma including two diffuse large B-cell non-Hodgkin's lymphoma (NHLs), one peripheral T-cell NHL, one anaplastic large cell (T/null cell) NHL, one follicular B-cell NHL and one nodular sclerosis Hodgkin's disease (HD). The sites of core-needle biopsy are shown in Table 1. Repeated core-needle biopsies were performed in five patients (6.25%). Nineteen patients (23.75%) with non-diagnostic core-needle biopsy underwent surgery depending on the sites, dimensions, and clinical diagnosis (Table 2). The histological classification in our group was according to 2001 World Health Organization classification of malignant lymphoma[15].

CT scanning

CT scanning was performed for all patients with incremental

Table 1 Sites of CT-guided core-needle biopsy in patients with lymphoma

	Number of patients	%
Mediastinum	42	52.5
Retroperitoneum	14	17.5
Abdominal mass	9	11.25
Spleen	2	2.5
Liver	2	2.5
Lung	1	1.25
Kidney	1	1.25
Chest wall	4	5
Pelvic wall	4	5
Extremity	1	1.25
Total	80	100.0

%: percentage of total biopsies.

Table 2 Management of non-diagnostic CT-guided core-needle biopsy

	Number of patients	%
Mediastinoscopy	3	15.79
Mediastinotomy	4	21.05
Lymphadenectomy	6	31.58
Exploratory laparotomy	6	31.58
Total	19	100.00

%: percentage of total biopsies.

scanning in cranial-to-caudal direction with 2.7-5 mm collimation on a CT twin flash scanner (Philips Co.). Before biopsies, all patients were subjected to enhanced CT to determine the exact tumor location, its degree of vascularity and the presence of necrosis. The optimal approach of needle was decided for deep or small lesions and lesions with extensive necrotic areas, avoiding damage to the important organs and relatively large vessels near the tumor (Figures 1A-C).

Biopsies

Biopsies were performed during the scanning with an 18-20 G biopsy-cut (CR Bard, Inc., Covington, GA, USA) needle driven by the spring-loaded Bard biopsy gun. The Bard biopsy gun consists of a hand-held device that triggers rapid firing of an 18 (20)-G cutting needle. When the gun is fired, an inner trocar with its 1.7 cm sample notch thrusts forward, followed by its outer cannula which shears a core of tissue with minimum crushing of the specimen[11,16]. For a satisfactory sampling, an average of three specimens was obtained during each CT-guided core-needle biopsy.

CT scanning was performed immediately after the biopsies to evaluate the possible complications such as bleeding or pneumothorax. Patients were kept under observation for 2 h and discharged, if there were no significant complications, and encouraged to contact their physicians if any evidence of complications developed subsequently.

Histologic analysis

All the samples were fixed in 40 g/L formaldehyde and embedded in paraffin and stained with hematoxylin and eosin. Routine immunohistochemical studies were performed using antibodies to leukocyte common antigen, cytokeratin, and vimentin. Histological subtyping of NHL was made using antibodies (CD3, CD8, CD15, CD30, CD43, CD79a, L26, UCHL-1, ALK, EMA).

A biopsy was considered successful, if the definite diagnosis and accurate classification of malignant lymphoma could be established and sufficient information was provided for a therapeutic decision.

RESULTS

No serious complications were noted in all the 80 patients who underwent CT-guided core-needle biopsy. A definite diagnosis and an accurate histological subtype were made in 61 patients with a success rate of 76.25%, including 80.82% (59/73) in NHL and 28.57% (2/7) in HD (Table 3). Nineteen patients (23.75%) with non-diagnostic core-needle biopsies were subjected to surgical interventions including mediastinoscopy, mediastinotomy, lymphadenectomy, and exploratory laparotomy. The main reasons for unsuccessful biopsy were extensive necrosis and unsatisfactory sampling.

The final histopathologic subtypes in 80 patients are listed in Table 4, including 63 NHLs and 7 HDs. In the diagnostic patient group, the majority of NHL subtypes were diffuse large B-cell NHL (*n* = 32) and peripheral T-cell NHL (*n* = 9). The remaining subtypes included one

Figure 1 CT-guided core-needle biopsy for paratracheal mass (**A**), large anterior mediastinal mass (**B**), and retroperitoneal mass (**C**).

lymphocyte-predominant HD, one lymphocytic depletion HD, six marginal zone B-cell NHLs, two diffuse small lymphocytic NHLs, three mantle B-cell NHLs, one follicular B-cell NHL, two angioimmunoblastic T-cell NHLs, and four anaplastic large cell (T/null cell) NHLs (ALCL).

The non-diagnostic patient group included two lymphocyte-predominant HDs, three nodular sclerosis HDs, four diffuse large B-cell NHLs, one mantle B-cell NHL, one follicular B-cell NHL, one Burkitt's NHL, one peripheral T-cell NHL, one angioimmunoblastic T-cell NHL, and five anaplastic large cell NHLs (ALCL, Table 4).

In our group, the success rates varied with the histopathologic subtypes. A relatively high success rate was obtained in diffuse large B-cell NHL (88.89%) and peripheral T-cell NHL (90%). However, the success rate was relatively low in anaplastic large cell lymphoma (ALCL, 44.44%) and HD (28.57%) in our group.

Table 3 Success rate of CT-guided core-needle biopsy

	Number of patients	%
HD	2/7	28.57
NHL	59/73	80.82
Total	61/80	76.25

HD: Hodgkin's disease; NHL: non-Hodgkin's lymphoma.

Table 4 Histologic classification in CT-guided core-needle biopsies

	Number of diagnoses	Number of non-diagnoses
HD	2	5
Lymphocyte-predominant	1	2
Lymphocytic depletion	1	–
Nodular sclerosis	–	3
B-cell NHL	44	7
Diffuse large B-cell	32	4
Marginal zone B-cell	6	1
Small lymphocytic	2	–
Mantle B-cell	3	–
Burkitt's	–	1
Follicular NHL	1	1
T-cell NHL	15	7
Peripheral T-cell	9	1
Anaplastic large cell (T/null cell)	4	5
Angioimmunoblastic	2	1
Total	61	19

HD: Hodgkin's disease; NHL: non-Hodgkin's lymphoma.

DISCUSSION

A satisfactory sampling for histological examination is fundamental to the diagnosis and management of malignant lymphomas[5,17]. Fine-needle aspiration (FNA) biopsies in the diagnosis of malignant lymphomas have been reported[18-20]. Core-needle biopsies were superior to FNA since histology is more reliable than cytology[21-23]. The use of CT guidance and improved histological diagnostic techniques have promoted the development of non-surgical sampling of tumor masses in almost any location[4,9]. Silverman *et al*.[24],

reported that image-guided biopsy of abdominal lymphoma provided an adequate tissue sample that enables treatment in 72% of patients. Pappa *et al*.[14], have achieved a diagnostic rate of 83% lymphomas, and suggested that image-guided core-needle biopsy should become the procedure of choice for histological sampling in the absence of peripheral lymphadenopathy. de Kerviler *et al*.[25], have reported, a relatively high success rate of 88%. Recently, Agid *et al*.[4], reported, that CT-guided core-needle biopsies are sufficient to establish a diagnosis of 82.5% patients with lympho-proliferative disorders and suggested that it should be used as the first step in diagnosis of lymphomas. In our group, 61 of 80 (76.25%) patients had a definite diagnosis and histological classification, and subsequent treatment was performed on the basis of the results of core-needle biopsy. CT-guided core-needle biopsy is therefore widely regarded as a quick, safe, and efficient alternative to excisional biopsy in patients without enlarged superficial lymph nodes[10,14].

The core-needle can acquire a relatively large specimen, which allows a better immunohistochemical staining[26,27]. CT-guided core-needle biopsy obviates the need for surgical biopsy in the majority of cases[4,9,25]. Automated biopsy systems such as Bard biopsy gun (CR, Inc., Covington, GA, USA) are rapid, simple, and highly efficient in sampling[11] and have been used as the commonest tool for percutaneous CT-guided biopsy in our hospital. Guided by CT, an 18-20 G needle is driven forward by the spring-loaded gun, and a biopsy specimen with a size of about 1.5-cm in length is rapidly cut, which is sufficient for imm-ohistochemistry staining for complete subtyping[14,16]. The reliability of CT-guided core-needle biopsy in diagnosis and classification of malignant lymphomas has largely been confirmed, and the opportunity of open biopsy or exploratory operation is greatly reduced[9,26].

In our study, 76.25% (61/80) of patients with malignant lymphoma underwent CT-guided core-needle biopsies and treated on the basis of biopsy results alone. However, the definite diagnosis and explicit histological classifications were not obtained by core-needle biopsy alone in 19 patients with malignant lymphomas. The most common reason for the failure of core-needle biopsy diagnosis is that satisfactory sampling is not obtained due to the extensive necrosis of the lesions[1,10]. In diagnosis of follicular lymphoma, very large follicular structures might potentially be missed by core-needle biopsy. However, this theoretical drawback is rarely encountered[16,28]. Also, primary diagnosis of uncommon lymphomas may be compromised by small samples obtained by needle biopsy, and as with biopsies negative for lymphoma, surgical intervention may be required[16,29]. Indeed, some subtypes of malignant lymphoma might not be definitely diagnosed and categorized by CT-guided core-needle biopsy alone[29,30]. Ben-Yehuda *et al*.[31], suggested that the most problematic category is mixed small- and large-cell NHL, because of the difficulty in making a reliable assessment of the relative number of large cells present and distinguishing diffuse from nodular patterns in these cases.

Due to its morphologic variations, anaplastic large cell (T/null cell) lymphoma (ALCL) might be mistaken for

other lymphoid or non-lymphoid malignancies[32]. In general, ALCL is of T-cell phenotype and characterized by the classic "anaplastic" morphology and a peculiar CD30 expression. Its diagnosis relies on recognition of distinctive morphologic clues, such as the presence of occasional "hallmark" cells, especially around small vessels, as well as immunopositivity for CD30 and occasionally ALK protein. Therefore, a definitive diagnosis of ALCL is possibly based on careful interpretation of immunohistochemical features[32,33]. If the explicit diagnosis of ALCL cannot be made on the basis of a small size of samples obtained by core-needle biopsy, the relatively larger specimen obtained by open biopsy may be needed for definite diagnosis.

A common subtype of lymphomas such as diffuse large B cell lymphoma often yields a predominant population of large lymphoid cells with a high mitotic activity and a relatively high rate of diagnosis[13,32]. The success rate was as high as 88.89% (32/36) in our group. However, there were nine patients (11.25%) with ALCL in our group, and a definite diagnosis by core-needle biopsy alone was made in only four (44.44%). The main reason for this failure is due to the small size of samples obtained by core-needle biopsy.

Zinzani et al.[13], and Pappa et al.[14], have reported, relatively high success rates in diagnosis of HD using core-needle biopsy. However, there were a relatively small number of patients with HD in our group (8.75%), and only 28.57% (2/7) of patients with HD were definitely diagnosed by core-needle biopsy. Except for unsatisfactory sampling[25], our low success rate may largely be due to lack of experience of pathological diagnosis of HD on the basis of core-needle biopsy in our hospital.

In conclusion, CT-guided core-needle biopsy is a reliable diagnostic procedure for malignant lymphoma, and can be widely used in patients with suspected malignant lymphoma in absence of palpable, enlarged superficial lymph nodes.

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