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Original Article

Comparison between Needle Biopsy under Guide of Conventional Computerized Tomography (CCT) and Fluoroscopic Computerized Tomography (FCT) in Abdominal, Mediastinal, Lung, Pelvic, Bone, and Liver Masses

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ABSTRACT

Background and Objective: **Computerized tomography and fluoroscopic computerized tomography are amongst the methods used for guiding needle biopsy processes; however, fluoroscopic computerized tomography demonstrates the images during the process of biopsy. This study aims to compare and contrast the success of biopsy under guide of computerized tomography and fluoroscopic computerized tomography, independently and based on the location of the mass.**

Materials and Methods: **This research was a descriptive study of case series type. For this purpose, 206 patients were evaluated who came to hospital in a one-year period because of a mass in an anatomic location and underwent biopsy of the mass under guide of computerized tomography and fluoroscopic computerized tomography and their pathological records were analyzed. The required data were extracted and were analyzed by SPSS software.**

Results: **In this study, among 206 subjects, 122 were examined under guide of fluoroscopic tomography and 84 under guide of conventional computerized tomography. In all anatomical locations of the mass except for mediastinum, negative cases of biopsy in conventional computerized tomography were more than fluoroscopic computerized tomography the total rate of success in fluoroscopic computerized tomography group was 86.1% and in conventional computerized tomography it was 76.2%.**

Conclusion: **The results of this study showed that the fluoroscopic computerized tomography in biopsy is more successful than conventional computerized tomography in pelvis, abdomens, bone and liver and this might be the result of the feasibility of watching the biopsy needle during the procedure.**

Key words: Needle biopsy, Computed tomography, Fluoroscopy

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Introduction

Radiological techniques have long been used in order to carry out more subtle surgeries. One of its uses is for the biopsy under guide of X-ray. Conventional computerized tomography (CCT) is one of the methods used successfully for guiding biopsy processes as well as drainage of abscesses (1). But unlike scenography and fluoroscopy, CCT does not provide a simultaneous watching of the scene of biopsy for the radiologist. Due to this reason, those processes which are carried out under guide of CCT take more time than other processes because the scene of any area where needle of biopsy or counter should be placed is. Fluoroscopic computerized tomography (FCT) is a helical CT scanner (slip-ring spiral) to which a high-speed array processor has been added and through this, the imaging speed has been increased. This system provides the images during the process and makes it possible to watch the images continuously one after another (2).

It was not possible to see the images during the process before (3). As long as FCT has been constructed, it has been used for the biopsies of pelvis, abdomen, brain, and thorax as well as drainage of abscesses (4). Not only does this process make doing the biopsy easier for the radiologist, but also has other advantages including shorter time of the process, less exposure to the radiation for the doctor as well as the patient, and easy and proper access to the tissue. Since biopsy is an invasive process which has physical as well as psychological consequences for the patient and in almost all cases, therapeutic decisions depends on the biopsy reports and in some cases these therapies are quite urgent, so it is better to carry out this process quickly and accurately on the specified tissue so that repeating the process and higher radiation exposure would be avoided. In recent years, some imaging centers around the country have been equipped with this system and in some of these centers biopsy is carried out under guide of such mechanisms. But, do the obtained results in Iran prove that biopsy under guide of FCT is more successful than CCT? And does such a difference exist in the examination of all masses in the body regardless of their place? If so, isn't it better to carry out biopsy processes under guide of new available apparatus instead of CCT? This study aims to compare and contrast the rate of success of CCT and biopsy under guide of FCT in masses existing in different parts of the body.

Materials and Methods

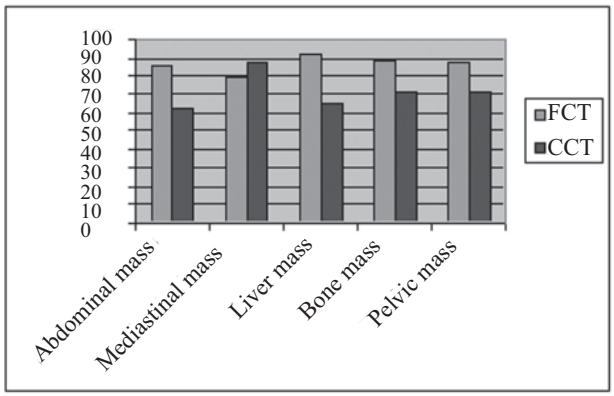
This research is a descriptive study of case series type. In this study, 206 patients who had affected by abdominal, pelvic, pulmonary, mediastinal and osseous masses and had come to imaging center of Imam Hospital Complex during a one-year period (1384) were allocated on a random basis to two centers by a radiologist for biopsy under guide of CCT and FCT and then their pathology reports were evaluated and regularized by a pathologist and those reports which included "repeat biopsy is needed", "tumor not seen", and "inconclusive" were considered as negative. The obtained data were recorded in a computer according to the place of the mass and then analyzed and compared using SPSS software (version 11.5).

Results

In this study, 206 subjects were selected based on a random sampling among the samples that had been biopsied under guide of CCT and RCT and were examined and analyzed based on the place of mass within them. Eighty one cases with the average age of 49.7 years (1-83) had mediastinal masses among which 43 cases were biopsied under guide of FCT biopsy and 38 under guide of CCT. Negative samples included 14 cases (17.3%) among which 9 (20.9%) cases belonged to FCT group. Forty cases of patients with the average age of 48.3 years (14-77) had osseous masses among which 26 persons were biopsied under guide of FCT biopsy and 14 persons under guide of CCT. Negative cases included 7 cases (17.5 %) among which 3 cases (11.5%) belonged to FCT group and 4 cases (28.6%) belonged to CCT group. Fifteen patients with the average age of 59.53 years (38-75) had abdominal masses among which 7 cases were biopsied under guide of FCT and 8 cases under guide of CCT biopsy. Negative samples included 4 cases (26.7%) among whom 1 case (4.3%) belonged to FCT group and 3 cases (37.5%) belonged to CCT group. Fifty five cases of patients with the average age of 53.67 years (11-75) had hepatic masses among whom 38 cases were treated under guide of FCT and 17 cases were treated under guide of CCT biopsy. Nine cases (16.4%) of this group had been reported as negative, 3 cases of which (7.9%) related to FCT group and 6 cases (35.3%) to the CCT group. In addition, 15 patients with an average age of 41.53 years had pelvic masses, 8 cases of whom had been treated under guide of FCT and 7 cases under guide of CCT biopsy. In this group, 3 cases (20%) were reported as negative

including 1 case (12.5%) was related to FCT and 2 cases (28.6%) to CCT. Totally, among 206 examined samples, 122 cases were examined under guide of FCT and 84 cases under guide of CCT. Total rate of success in FCT group was 86.1% and in CCT group it was 76.2% (Figure 1).

Figure 1. Rate of success of needle biopsy under guide of CCT and FCT in patients with masses in different locations



Discussion

In a study carried out in the radiology division of Brigham Maternity Hospital (Boston, USA), 143 patients with abdominal or pelvic masses who had reported their disease from August 1997 to February 1998 were studied. In this regard, 107 patients were treated with biopsy or drainage processes under guide of FCT and 36 under guide of CCT and the results were compared in separate groups. In processes under FCT, the results were as follows: negative predictive value = 86%, sensitivity = 98% and success rate = 100% and under guide of CCT, negative predictive value = 80%, sensitivity = 95% and success rate = 97% (5). The results of this study like ours showed higher percentage of success rate for FCT as compared to CCT. In another study carried out in respiratory division of Red Cous in Japan, FCT was used for needle biopsy of 16 patients with opacity in the X-ray of their lung. In this respect, 15 biopsies were carried out successfully and for 13 cases final diagnosis were laid. The required time for carrying out these processes varied between 16 to 45 minutes and finally it was concluded that FCT is quite efficient for the biopsy of small masses or masses near blood vessels or in the mediastinum or masses which can hardly be seen in routine radiography (6).

The results we obtained from the biopsy of mediastinal masses were less efficient than this study on FCT. In our study, CCT was more efficient for mediastinal masses. In a study carried out in the radiology section of Beth Deacones Medical Center (Boston, USA), FCT was used for needle aspiration inside the lesion of trachea of 12 patients suffering from lymphadenopathy in the mediastinum and had previously been treated by common needle aspiration inside the trachea. All these procedures were carried out in less than one hour and tissue diagnosis became possible in all of them (7). In another study carried out by Brown and Shweigere (L.A, USA), 11 biopsies and 2 cases of emptying abscesses were carried out under guide of FCT and since these patients suffered from sever damage in colon and small intestine or near the blood vessels, it was difficult and unsafe to carry out this procedure under guide of CCT. In 11 patients, this procedure was carried out successfully and in 10 patients final decision was made (8). In another study carried out in Therapeutic Imagining Unit of Vinant's St (Australia), the obtained results showed that the amount of confrontation with the rays by the radiologist as well as radiology personnel in procedure under guide of FCT is less than CCT and the possibility of access to small masses and masses which are not accessible through CCT would become possible through FCT (9). In another study carried out in Hern (Germany), 75 patients under guide of FCT (50 cases) or CCT (25 cases) were treated by the thoracic (29 cases) or abdominal (46 cases) drainage. The average time required for carrying out these procedures was remarkably different. The sensitivity and specificity of these two methods were as follows (10): FCT: sensitivity = 71%, specificity = 100%, positive predictive value = 100%, negative predictive value = 60%; CCT: sensitivity = 68%, Specificity = 100%, PPV = 100%, NPV = 50%.

The results of this study confirmed our study, i.e. the rate of success in abdominal masses in FCT was higher than from CCT (85.7% to 62.5%). The results of another study carried out in the radiology division of Philip University hospital in Baldungerstaree (Germany) on the biopsies under guide of FCT and CCT showed that the number of times needle was entered for biopsy in FCT was less than from CCT and the time required for carrying out this process was in FCT was less than from CCT and so the amount of radiation was also less in FCT (11). In another study carried out in imaging division of High-tech

Medical Center of Nippon (Japan), 26 patients were biopsied under guide of FCT. The average size of the examined nodules was 1.2 cm and the average of their distance from the skin was 5.5 cm. In pathology results, 23 malignant cases, 2 benign cases or specific inflammation and just one case of insufficient sample were reported. There was no negative false case and the result showed that for carrying out the biopsy, pulmonary nodules which were smaller than 2 cm, this method would be quite valuable (12-14). Totally, the obtained results showed the superiority of the ability of FCT compared to CCT in carrying out biopsies in pelvis, abdomen, bone and liver and this is the result of watching the scene of biopsy during the operation which is possible for the radiologist in FCT. The difference in the rate of success in hepatic mass is higher (64.7% to 92%) and this leads us to suggest the more frequent use of biopsy under guide of FCT for hepatic mass. FCT has its own disadvantages including that FCT has several advantages both of which are lower degrees of radiation for the patient and higher speed, but if it is not used appropriately and high current is applied for a long time, this method can have more damages resulting from higher radiation, compared to CCT and it also causes more radiation on the radiology personnel and is expensive also. The Committee of Food and Medicine Radiation Safety Standards expressed its concern about FCT (5,15). These concerns included the difficulty of precise and appropriate regulation of this method, the capability of causing high degrees of radiation for the patient and the personnel as well as insufficient knowledge for using this method and dermal contamination resulted from this method (2,15). The biopsy results of mediastinal masses are more accurate and successful, with CCT compared to FCT (FCT: 79.1%, CCT: 86.8%) and this is in contrast the biopsy results that taken from other locations of the body. This finding may be due to technique used in mediastinal mass biopsies and required much further investigation in a lager number of cases.

Conclusion

Considering the results of this study, if FCT is used appropriately, regarding the amount of radiation and regulating the current and the time taken, it can be suggested and prioritized for the biopsies of masses of most parts of the body such as bones, abdomens, liver, and pelvis.

References

1. Mueller PR, vanSonnenberg E. Interventional radiology in the chest and abdomen. N Engl J Med 1990 May 10;322(19):1364-74.

2. Marti-Bonmati L, Masia L, Torrijo C, Casillas C, Ferrer MD. Dynamic MR imaging of liver tumors: analysis with temporal reconstruction images. Radiology 1994 Dec;193(3):677-82.

3. Haaga JR, Alfidi RJ. Precise biopsy localization by computer tomography. Radiology 1976 Mar;118(3):603-7.

4. Froelich JJ, Saar B, Hoppe M, Ishaque N, Walthers EM, Regn J, et al. Real-time CT-fluoroscopy for guidance of percutaneous drainage procedures. J Vasc Interv Radiol 1998 Sep;9(5):735-40.

5. Silverman SG, Tuncali K, Adams DF, Nawfel RD, Zou KH, Judy PF. CT fluoroscopy-guided abdominal interventions: techniques, results, and radiation exposure. Radiology 1999 Sep;212(3):673-81.

6. Tsuchiyama T, Ueda K. [The usefulness of thoracic needle biopsy under computed tomographic fluoroscopy]. Nihon Kokyuki Gakkai Zasshi 2000 Jun;38(6):425-9.

7. Goldberg SN, Raptopoulos V, Boiselle PM, Edinburgh KJ, Ernst A. Mediastinal lymphadenopathy: diagnostic yield of transbronchial mediastinal lymph node biopsy with CT fluoroscopic guidance-initial experience. Radiology 2000 Sep;216(3):764-7.

8. Schweiger GD, Yip VY, Brown BP. CT fluoroscopic guidance for percutaneous needle placement into abdominopelvic lesions with difficult access routes. Abdom Imaging 2000 Nov;25(6):633-7.

9. Law EM, Little AF, Salanitri JC. Non-vascular intervention with real-time CT fluoroscopy. Australas Radiol 2001 May;45(2):109-12.

10. Kirchner J, Kickuth R, Laufer U, Schilling EM, Adams S, Liermann D. CT fluoroscopy-assisted puncture of thoracic and abdominal masses: a randomized trial. Clin Radiol 2002 Mar;57(3):188-92.

11. Froelich JJ, Ishaque N, Regn J, Saar B, Walthers EM, Klose KJ. Guidance of percutaneous pulmonary biopsies with real-time CT fluoroscopy. Eur J Radiol 2002 Apr;42(1):74-9.

12. Okajima Y, Tajima H, Kumazaki T, Onda M. Clinical application of a CT-guided lung biopsy system: core needle biopsy at the IVR center. J Nippon Med Sch 2002 Oct;69(5):434-44.

13. Susan JN, Peter GD, Kirsten LG. Radiology In Surgical Practice. New york: Churchill Livingstone; 2006.

14. Jerald PK, Thomas LS, Jacko H. Caffeys Pediatric Diagnostic Imaging. 10 ed. Philadelphia: Mosby Elsevier; 2004.

15. Tawnia A, Richard A, Vincent DB, Rajiv S, Gray DS, Ruth GR. Clinical Imaging. 2 ed. St. louis: Mosby; 2005.