

ORIGINAL ARTICLE

**THE SAFETY OF IMAGE-GUIDED BIOPSY AND ITS IMPACT ON PATIENT CARE:
THE FIRST ETHIOPIAN EXPERIENCE**Tesfaye Kebede, MD,¹ Korosh Khalili, MD,² Abebe Habtamu, MD³ Fikadesilasie Henok, MD⁴**ABSTRACT**

Introduction: *The introduction of image-guided biopsy has revolutionized the quality of patient care by avoiding open surgical biopsies and complications associated with it and the use anesthesia. Even though Ethiopian radiological training dates back to more than two decades, interventional radiology is a very recent introduction. This study reports the safety and significance of image guided biopsy on patient care.*

Patients and methods: *This study was a prospective study carried out to assess the impact and safety of doing image-guided biopsy in a tertiary care teaching Hospital in Addis Ababa, Ethiopia.*

Results: *A total of 117 patients, their age ranging from 3 to 80years and a mean age of 41 were evaluated; 6.8% of them were children below the age of 10. Around two-thirds of the cases had intra-abdominal indications for biopsy followed by mediastinal pathologies. Ultrasound was used as a guide in about 85% of the cases. Except for one case that developed massive hemoptysis following fine needle aspiration of a middle mediastinal mass and treated conservatively, there was no major complication. A few minor complications, like mild pain and minor hemorrhage, required only close observation.*

Conclusion: *On the whole, our study indicates that image-guide biopsy improves the existing medical care. Moreover, institutions particularly those providing training in radiology should promote the establishment of interventional radiology for better patient diagnosis and improved planning of subsequent treatment.*

Keywords: *Safety, Image-guided biopsy*

INTRODUCTION

Image guided biopsy is known to improve the quality of medical care by providing information regarding the staging of malignant neoplasm and guide the subsequent medical as well as surgical treatment of cases. Particularly in setups where tuberculosis is rampant which sometimes mimic primary as well as secondary neoplasm, simple clinical, laboratory and radiological differentiation may be a challenge. In such cases image guided biopsy will markedly and positively affect subsequent patient management. Currently, image guided biopsies are performed with a high rate of accuracy and only minimal rates of complication and patient discomfort even in cases with deep seated retroperitoneal masses (1). In organs like the spleen with focal lesions, even in those who have known primary site where differentiation is crucially important for effective therapeutic decisions, image-guided Fine Needle Aspiration Cytology (FNAC/Biopsy has substantial impact (2,3) and it is safe (4). For example, differentiating metastasis from splenic lymphoma and infection cannot reliably be made from all imaging including radionuclides. IGB is also important in establishing common disease processes with rare manifestations which may affect the subsequent patient management (5).

The safety of FNA is well established even if complications may occur. Complications are often managed conservatively and rarely need surgical intervention (6). Ap-

plication of image-guided biopsy/FNAC in pediatrics has also been reported to be safe and accurate (7). Especially in liver sampling, the accuracy of image guided biopsy is not limited to larger liver masses, but accuracy is high even for small masses <3cm even in the presence of cirrhosis(8). Since the introduction of image-guided biopsy in the teaching Hospital at Addis Ababa University (AAU), significant numbers of open surgical biopsies and empirical drug treatments have significantly reduced. That has, in turn, reduced the burden to the referring clinicians and the cost of admission, hospital stay and complications associated with general anesthesia and surgery. One should also consider having a good relation between different disciplines for the success of the procedure (1,9).

The hospital where the study was conducted is a tertiary health facility where most high end professionals are working and advanced medical care is provided. However, until very recently, patients have been subjected to open surgical diagnostic biopsies. The use of image-guided biopsy could have made diagnosis less invasive and avoid complications associated with surgery and anesthesia. More conveniently, image-guided biopsy could have been administered with outpatients avoiding all the steps associated with admission. This study thus reports the safety and significance of image- guided biopsy on the current patient care in the institution, which could bring a major shift from open surgical biopsy to image guided biopsy / FNA.

¹Department of Radiology at School of Medicine, College of Health Sciences, Addis Ababa University ²Department of Radiology at University of Toronto ³Department of Pediatrics at School of Medicine, College of Health Sciences Addis Ababa University ⁴Department of Surgery at School of Medicine, College of Health Sciences, Addis Ababa University * Corresponding email: kebedetesfaye@yahoo.com

PATIENTS AND METHODS

This is a prospective cross-sectional study conducted at Tikur Anbessa Specialized Hospital (TASH), which is a university hospital at college of Health Sciences, Addis Ababa University. TASH is the only central referral Hospital of the country. The study is conducted during the year 2012-2013 at TASH, Department of Radiology. Image-guided biopsy, particularly ultrasound-guided, was introduced together with the commencement of Body Imaging Fellowship Program in 2012. Since then, proper real time image-guided biopsies are being done at TASH.

In this study, we included all patients who visited the Department of Radiology at TASH for image guided biopsy/FNAC during the period of 2012 and 2013. Patients who had image-guided biopsy done but whose pathological results were not obtained were excluded from the study. Data were collected by the principal investigator and by the Department nurses who were working mainly on interventional procedures and by using a structured questionnaire which was filled by the nurses. The study variables in the questionnaire included: socio-demographic characteristics, indications for image-

guided biopsy, modality used for guidance, organ biopsied, complication associated with the biopsy/FNAC, pathological results, repeat biopsy/FNAC in inconclusive cases and pathological results too. Variables were entered into SPSS 16 and frequency distributions of variables were summarized using graphs, tables and pie charts.

Image guided biopsy was done as part of patient work-up, but not for the purpose of the research. Patients were watched for complication as part of the standard of care and those who developed complications were managed accordingly. Ethical clearance to conduct the research was given from the research and ethics committee of the department of radiology.

RESULTS

Among the total number 117 patients included in this study; 60% were males and 40% females. Their age ranged from 3 years to 80years with a median age of 46 years. Sixty one per cent of the cases were between 21 and 50 years and children less than 10 years constituted 6.8% (Figure 1). Eight percent of the biopsies were done for intra-abdominal lesions, which included intra-abdominal nodes followed by mediastinal, thoracic and chest wall masses (Table 1).

Table 1: Frequency distribution of the different organs biopsied in patients at Tikur Anbessa Specialized Hospital in the years 2012-2013

Site of Specimen	Freq.	Percentage (%)
Mediastinal/ Hilar Mass	20	17.1
Anterior	13	11.1
Middle	3	2.6
Posterior	3	2.6
Hilar	1	0.9
Lung Lesions	12	10.3
Pulmonary nodule	1	0.9
Pulmonary mass	5	4.2
Consolidation	2	1.7
Pleural mass	1	0.9
Chest wall mass	3	2.6
Abdominal lesions	48	41
Liver mass	31	26.5
Splenic lesions	2	1.7
Gastric mass	3	2.6
Bowel masses	2	1.7
Omental mass	1	0.9
Renal mass	3	2.6
Pancreatic mass	1	0.9
Paraspinal lesion	3	2.6
Adrenal	2	1.7
Intera- Abdominal Nodes	26	22.2
Periportal	1	0.9
Mesenteric	1	0.9
Retroperitoneal	24	20.5
Peritoneal Collection	1	0.9
Retroperitoneal Mass	4	3.4
Pervic Mass	1	0.9
Scrotal Mass	5	4.2

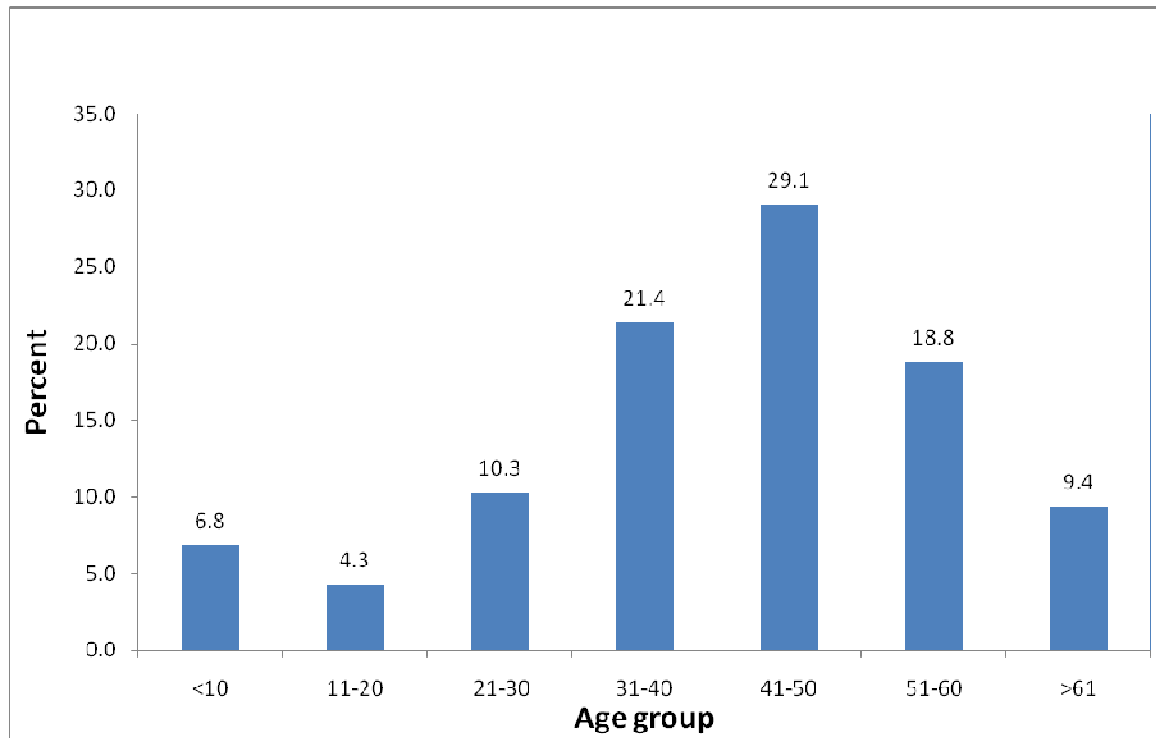


Figure 1: Age group of subjects for whom biopsy was done at TASH in the year 2012-2013

As shown in Figure 2 below, most of the guidance (85%) were done with ultrasound. Computerized tomography was used as guidance for 15% of the cases. It could be said that complications resulting from the image guided biopsies were quite minimal. Only 2 people for whom CT guided FNAC were done for lung parenchymal lesion developed small hemopneumothorax which did not need intervention except close observation. Other than

that, one patient for whom CT guided FNAC was done for tracheo-bronchial mass lesion developed massive hemoptysis. The patient was positioned with biopsy side down and resuscitated with intravenous fluids and bleeding controlled. As shown in Table 2 below, in the majority of cases, post procedure pain is the most common complication we observed.

Table 2: Complication associated with the biopsy for patients at in the years 2012-2013

Complications	No	Percent
Hemopneumothorax	2	1.7
Hemoptysis	1	0.9
Hemorrhage	1	0.9
None	9	7.7
Pain	103	88.0
Vasovagal reaction	1	0.9
Total	117	100.0

Most liver masses were hepatocellular carcinoma if they are solitary and metastasis if multiple 37.5% of the retroperitoneal nodal lesions were due to tuberculosis and 29.4% were lymphomas (either primary or recurrent lymphomas) (Table 3)

One of the three Para spinal lesions had solitary vertebral collapse and it was sent for radiotherapy with the diagnosis of metastasis. As a routine workup of oncologic cases, ultrasound guided aspiration of the paraspinal lesion was done revealing caseous tissue and proved cytologically to be tuberculosis.

One patient was put on first line anti-tuberculosis drugs based on clinical and radiological diagnosis. However, after eight months of treatment, no clinical as well as radiological improvements were noted. US guided aspiration revealed caseous tissue which turned out to be tuberculosis whose culture of the specimen later indicated it to be multidrug resistant strain.

Out of 117 cases, 9 cases (7.7%) turned out to have inconclusive pathological reports as result of which all patients were advised to have repeat procedure. Three of them refused to have repeat procedure. Except one case (that is one of the anterior mediastinal masses) for which the repeat procedure was done with different guidance modality from the initial, all repeat procedures were done with the same modality as the initial one. Among the six cases for whom repeat procedure was done, only one case was found to have an inconclusive result even after the repeat (Table 4).

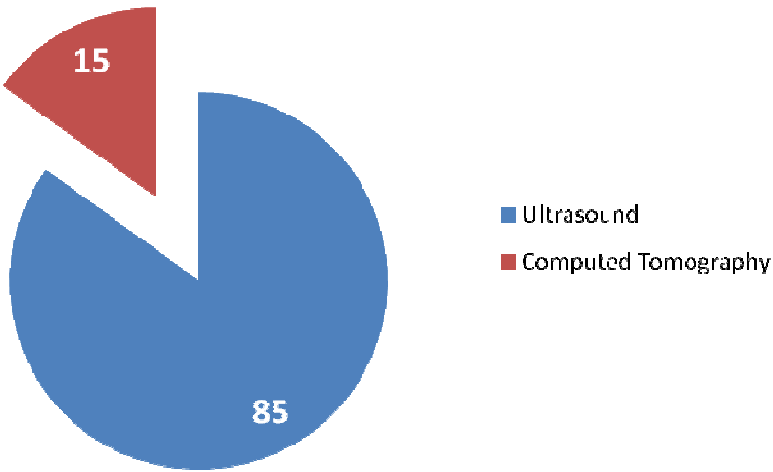


Figure 2: Imaging modality used for guidance for biopsy for patients at TASH in the years 2012-2013

Table 3: Distribution of sites biopsied and their pathological result for patients at TASH in the years 2012-2013

Lesion biopsied	Pathological DX	Freq.	Percent
Solitary liver mass		17	
	Abscess	4	23.5
	Cholangiocarcinoma	3	17.6
	HCC	6	35.3
	Hematoma	1	5.9
	Hepatoblastoma	1	5.9
	Metastasis	2	11.8
Multiple liver masses		14	
	Metastasis	7	50
	Tuberculosis	1	7.1
	Abscess	1	7.1
	HCC	1	7.1
	Hemangioma	1	7.1
	Lymphoma	2	14.3
Retroperitoneal nodes		24	
	Lymphoma	6	25
	Lymphoma recurrence	1	4.2
	Reactive	8	33.3
	Tuberculosis	9	37.5
Mediastinal masses		17	
Anterior		12	
	Thymoma	7	41.2
	Lymphoma	2	11.8
	Thymic Carcinoid	1	5.9
	Malignant Epithelial Neoplasm	1	5.9
Middle		3	
	lymphoma	2	11.8
	Carcinoid	1	5.9
Posterior		2	11.8
	Fibrosarcoma	1	5.9

Table 4: Characteristics of cases whose initial pathological exam were inconclusive done at TASH in the year 2012-13

No. of cases	Site biopsied	Initial modality used	Agreed to have repeat procedure	Modality used for repeat procedure	Diagnosis
1	Anterior mediastinal mass	CT	No		
1	Anterior mediastinal mass	US	Yes	US	Lymphoma
1	Anterior mediastinal mass	US	Yes	CT	Lymphoma Adenocarcinoma
1	Right hilar mass	CT	Yes	CT	
1	Posterior mediastinal mass	US	No		
1	Liver mass	US	Yes	US	Inconclusive
1	Peritoneal collection	US	No		
1	Persistent consolidation	US	Yes	US	Separative inflammation
1	Retroperitoneal mass	US	Yes	US	Mesenchymal neoplasm

DISCUSSION

Image guided biopsy has long been known to have higher sensitivity and specificity for establishing the diagnosis and avoiding empirical treatment and unnecessary open surgical biopsies as well as exploratory surgical intervention. Even if the introduction of image guided biopsy in Ethiopia is only two year old, the findings of the present study show that it has a yield of about 93% effectiveness. In addition, following its introduction, most open surgical biopsies and exploratory surgeries were avoided. Prior to the introduction of image guided biopsy, those procedures were the only options available for the referring physician. Although most of the specimens were taken using FNA, we encountered very low rate of complication which almost all needed only observation. As was the case with other studies we used US for most of the lesions. That was done not only because of its wide availability but also because of its cost, its ability of guiding in different planes and lack of radiation. On top of that, US is very effective alternative for sampling small intra-abdominal, retroperitoneal and pelvic nodes with a reasonably high success rate(10).

Liver: Most FNAC/ Biopsy in the abdomen are done to confirm the diagnosis of solitary liver mass lesion and of multiple liver masses in patients who have no obvious primary focus followed by lymph nodes, especially retroperitoneal nodes. Overall liver masses were the most common indications for biopsy in our series and even in other literature (6). Ultrasound was used as guidance for all liver lesions in our case and also in most institutions worldwide with high accuracy (11). Even if trans jugular biopsy is also used for liver masses which is more invasive and needs expertise, US and CT guided biopsies are shown to be as efficacious and safe as that of trans jugular biopsies and complication cannot be prevented by trans jugular biopsy (12). Except hemorrhage within the solitary liver mass itself, which turned out to be HCC, no major complication occurred. Even though a number of major complications can occur associated with liver biopsy in worst cases including death (13), no complication was observed in our series. A number of explanations could be given for the limited complications reported in this study. To start with, most of our samples were taken with only FNAC. Secondly, meticulous screening was made: a) to avoid high risk patients and b) not to subject patients for whom accurate diagnosis was made during review of previous scanning. Added to that, biopsies for patients who have known primary tumor with liver metastasis were not done unless knowing the specific histologic type is crucial to choose the modality of subsequent treatment. During the time where image guided biopsy were not available, such patients would be subjected to image assisted FNAC/Biopsy whose accuracy was not studied in our setup; otherwise,

they would have a combined clinical and radiological diagnosis and management started subsequently. It was also challenging for the following physician to label the lesion as benign /malignant and council the patient accordingly in public institutions, like Tikur Anbessa Specialized Hospital, where even having CT scan is unaffordable for most of the patients. Even if most of multiple liver masses are turned out to be metastases, the one patient who finally turned out to be tuberculosis was labeled as having liver metastasis with unknown primary and was sent to an oncologist and was found on pretreatment workup. Although we should consider metastasis as the most common cause of multiple liver masses everywhere in the world, in areas which are endemic to tuberculosis one should keep in mind the possibility of tuberculosis.

Intra-abdominal nodes: The safety and accuracy of image guided intra-abdominal nodes are well established and particularly of US guided biopsies which has an added advantage over CT due to lack of ionizing radiation, its portability, shorter procedure time, and real-time visualization of the needle throughout the procedure and because of its cost efficiency (8). Image guided biopsy also enables determination of tumor grading and treatment regardless of needle size. Before the introduction of image guided procedures in the hospital where this study was conducted, the options for patients having only intra-abdominal enlarged nodes is most likely is to decide based only on the clinical and laboratory findings or initiate empirical treatment (mostly first line anti-tuberculosis drugs) due to the hyperendemicity of the place.

As shown in the present study, it can be argued that the introduction of US guided biopsy of retroperitoneal nodes significantly changes the management approach by establishing the diagnosis prior to initiation of therapy. Unlike the literature from developed world where tuberculosis is the least common cause of retroperitoneal enlarged nodes, (10, 14) most of the nodal diseases in the study area occur due to tuberculosis. Even if tuberculosis is the leading cause of nodal lesions in our case, a significant number of cases were either lymphomas or reactive nodal lesions. This avoided unnecessary observations or empirical anti-tuberculosis treatment.

Intra-thoracic lesions: The value of image guided percutaneous transthoracic lesion biopsy is a well-established and safe procedure. Even if CT is mostly used in intrathoracic lesions, US is shown to be a good alternative and cost effective modality for especially for mediastinal lesions(15). Particularly in setups where more invasive procedures like open surgical biopsy is the only option, percutaneous biopsy is an accurate, safe, rapid procedure with only few rates of manageable complications. In addition, image guided biopsy enables referring clinicians for having optimal therapeutic strategies, including stages of the disease and preoperative management if the patient has operable tumors. Because of the recent development

in administering selected chemotherapeutic and targeted therapy, histological diagnosis of lung cancers are becoming so important. That has increased the role of image guided biopsy on therapeutic planning. It has also enabled the treating physician to know the specific tumor type so that they can plan for medical therapy for those who are chemo sensitive, for patients with non-resectable lesions or for those who have impaired cardiopulmonary function which made them poor surgical candidates. It also avoids long hospital stay and the morbidity and mortality associated with anesthesia and surgery. Even in cases where the initial FNAC/Biopsy is inconclusive, repeating the procedure is shown to be helpful rather than switching to more invasive procedures. In the hospital where this study was conducted, patients should wait long (mostly more than three months) to have open surgical biopsy and will stay for a minimum of three days after the procedure.

Considering that the few complications reported in the present study that only need observation and given that it could be managed conservatively, we can say that image guided percutaneous FNAC/Biopsy safeguards our cardiothoracic surgeons. In more practical sense, it is also cost effective. In comparison with the widely used practice that requires cost of admitting, anesthesia, surgery and hospital stay especially in resource poor settings like ours, image guided percutaneous FNAC/Biopsy entails a safe outpatient procedure with percutaneous sampling.

Most of our samples are taken with FNAC because of lack of core biopsy needles in our setup but future practices should also try to have more core biopsy specimens and combination of the two which is shown to have a high accuracy(16). Avocations also need good relation of the performing radiologist with the referring clinicians as attested in our experience and shown in other centers (1). There was very close and friendly relationship between radiologists, gastroenterologists, surgeons and pulmonologists where most of our cases are referred through personal communications. This showed our referring colleagues how safely the procedure can be done and facilitated the subsequent patient diagnosis and management.

Scrotal and retroperitoneal biopsies: All five of our cases presented with painless scrotal mass lesions turned out to have tuberculosis. Unlike developed nations where

most scrotal masses are neoplastic, Biopsy in scrotal masses but in areas where there is high prevalence of infection, biopsy should be done to confirm the diagnosis. This study showed the safety and accuracy of image guided FNA of retroperitoneal masses, which its accuracy can approach 100% in literature(1). Unlike previous times where surgical exploration and excisional biopsy was the only option, because retroperitoneal mass biopsy with semi guidance is risky and difficult, image guided FNAC facilitates the subsequent management and preoperative planning.

Image guided biopsy in pediatrics: We did all our image guided biopsies with local anesthetic agents except in children under 10 years and for older uncooperative children where we used conscious sedation in addition to the local anesthetics. No major complications were encountered. Image guided biopsy can safely be done in children and avoids unnecessary open surgical biopsies and exploratory surgeries. In our setup where almost all patients are of low socioeconomic status who hardly afford ancillary laboratory investigation and some radiological investigations like CT and MRI, ultrasound plays a key role as guidance especially in pediatrics

As a conclusion: Image guide biopsy is reported to have brought a revolution in patient care by facilitating histological diagnosis in a less invasive manner on outpatient level. It also avoids empirical medical therapy and complications associated with it. It has very low complication rate which almost all need only observation with few requiring conservative management. Apparent in image guide biopsy is also no life threatening complications which need subsequent medical or surgical intervention. US is a very effective guiding modality for almost all intra-abdominal and intra-thoracic pathologies especially those of mediastinal lesions which are in contact with the pleura or chest wall.

The responsible institutional leaders should be aware of the value and impacts of introducing image guided biopsy and discuss with the faculty on the feasibility of establishing the interventional unit particularly those running radiological training. Training of staffs performing the procedure on conscious sedation will enable them handle pediatric patients and those who are uncooperative.

REFERENCES

1. Mehdi G, Maheshwari V, Afzal S, Ansari HA, Ahmad I. Image-guided fine-needle aspiration of retroperitoneal masses: The role of the cytopathologist. *Journal of cytology / Indian Academy of Cytologists*. 2013 Jan;30(1):36-41. PubMed PMID: 23661939. Pubmed Central PMCID: PMC3643360. Epub 2013/05/11. eng.
2. Agha-Mohammadi S, RY C. Solitary splenic metastasis: case report and review of the literature. *Am J Clin Oncol*.

4. McInnes MD, Kielar AZ, Macdonald DB. Percutaneous image-guided biopsy of the spleen: systematic review and meta-analysis of the complication rate and diagnostic accuracy. *Radiology*. 2011 Sep;260(3):699-708. PubMed PMID: 21693659.
5. El-Sharkawi D, Ramsay A, Cwynarski K, et al. Clinico-pathologic characteristics of patients with hepatic lymphoma diagnosed using image-guided liver biopsy techniques. *Leukemia & Lymphoma*. 2011 Nov;52(11):2130-4. PubMed PMID: 21702647.
6. Welch TJ, Sheedy PF, 2nd, Johnson CD, Johnson CM, Stephens DH. CT-guided biopsy: prospective analysis of 1,000 procedures. *Radiology*. 1989 May;171(2):493-6. PubMed PMID: 2704815. Epub 1989/05/01. eng.
7. Somers JM, Lomas DJ, Hacking JC, Coleman N, Broadbent VA, Dixon AK. Radiologically-guided cutting needle biopsy for suspected malignancy in childhood. *Clinical radiology*. 1993 Oct;48(4):236-40. PubMed PMID: 8242998. Epub 1993/10/01. eng.
8. Memel DS, Dodd GD, 3rd, Esola CC. Efficacy of sonography as a guidance technique for biopsy of abdominal, pelvic, and retroperitoneal lymph nodes. *AJR American journal of roentgenology*. 1996 Oct;167(4):957-62. PubMed PMID: 8819394. Epub 1996/10/01. eng.
9. Khankan AA, Al-Muaikeel M. Image-guided percutaneous transthoracic biopsy in lung cancer--emphasis on CT-guided technique. *Journal of infection and public health*. 2012 Dec;5 Suppl 1:S22-30. PubMed PMID: 23244183.
10. Fisher AJ, Paulson EK, Sheafor DH, Simmons CM, Nelson RC. Small lymph nodes of the abdomen, pelvis, and retroperitoneum: usefulness of sonographically guided biopsy. *Radiology*. 1997 Oct;205(1):185-90. PubMed PMID: 9314983. Epub 1997/10/07. eng.
11. Howlett DC, Drinkwater KJ, Lawrence D, Barter S, Nicholson T. Findings of the UK national audit evaluating image-guided or image-assisted liver biopsy. Part I. Procedural aspects, diagnostic adequacy, and accuracy. *Radiology*. 2012 Dec;265(3):819-31. PubMed PMID: 23175545.
12. Hardman RL, Perrich KD, Silas AM. Single-institution results of image-guided nonplugged percutaneous versus transjugular liver biopsy. *Cardiovascular and interventional radiology*. 2011 Apr;34(2):369-75. PubMed PMID: 20963589.
13. Howlett DC, Drinkwater KJ, Lawrence D, Barter S, Nicholson T. Findings of the UK national audit evaluating image-guided or image-assisted liver biopsy. Part II. Minor and major complications and procedure-related mortality. *Radiology*. 2013 Jan;266(1):226-35. PubMed PMID: 23143026.
14. Silverman SG, Lee BY, Mueller PR, Cibas ES, Seltzer SE. Impact of positive findings at image-guided biopsy of lymphoma on patient care: evaluation of clinical history, needle size, and pathologic findings on biopsy performance. *Radiology*. 1994 Mar;190(3):759-64. PubMed PMID: 8115624. Epub 1994/03/01. eng.
15. Rubens DJ, Strang JG, Fultz PJ, Gottlieb RH. Sonographic guidance of mediastinal biopsy: an effective alternative to CT guidance. *AJR American journal of roentgenology*. 1997 Dec;169(6):1605-10. PubMed PMID: 9393174. Epub 1997/12/11. eng.
16. Gong Y, Sneige N, Guo M, Hicks M E, A. MC. Transthoracic fine-needle aspiration vs concurrent core needle biopsy in diagnosis of intrathoracic lesions: a retrospective comparison of diagnostic accuracy. *Am J Clin Pathol* 2006;125(3):438-44.