Percutaneous image-guided needle biopsy in children – summary of our experience with 57 children

Abstract  Background. Percutaneous image-guided needle biopsy in children has been slower to gain acceptance than in adults where it is regarded as the standard clinical practice in screening suspicious masses.

Objectives. To report our experience with percutaneous image-guided needle biopsy in the pediatric population and assess its clinical use, efficacy and limitations.

Material and methods. Sixty-nine percutaneous image-guided needle biopsies were performed in 57 children. The age of the children ranged from 4 days to 14 years (mean 5.6 years). We used 16- to 20-gauge cutting-edge needles. Sixty-two biopsies were core-needle biopsies and 7 fine-needle aspiration biopsies.

Results. There were 50 malignant lesions, 10 benign lesions and 2 infectious lesions. In 55 (88.7%) lesions the needle biopsy was diagnostic. In 7 (11.3%) the biopsy was non-diagnostic and the diagnosis was made by surgery. Core-needle biopsy was diagnostic in 47 of 50 (94%) of the malignant solid tumors. In 3 out of 5 children with lymphoma, an accurate diagnosis was obtained with needle aspiration. Seven children underwent a repeated core-needle biopsy, (5 for Wilms’ tumor and 2 for neuroblastoma) that was diagnostic in all cases. All the biopsies were performed without complications.

Conclusion. Percutaneous image-guided needle biopsy is a simple, minimally invasive, safe and accurate method for the evaluation of children with suspicious masses. These data suggest that image-guided needle biopsy is an excellent tool for diagnosing solid tumors in the pediatric population. Negative studies should be considered nondiagnostic and followed by excisional surgical biopsies when clinical suspicion of malignancy is high.

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Miriam Sklar-Levy
Pinhas Daniel Lebensart
Yakov H. Appibaum
Nilli Ramu
Arnold Freeman
David Gozal
Eitan Gross
Yoav Sherman
Jakob Bar-Ziv
Eugine Libson

M. Sklar-Levy · P.D. Lebensart · Y.H. Appibaum · J. Bar-Ziv · E. Libson
Department of Radiology, Hadassah University Hospital, P.O.B 12000, Jerusalem, Israel
E-mail: izar56@hotmail.com
Tel.: 972-2-6776901
Fax: 972-2-6437531

N. Ramu · A. Freeman
Department of Pediatrics, Hadassah University Hospital, Jerusalem, Israel

D. Gozal
Department of Anesthesiology, Hadassah University Hospital, Jerusalem, Israel

D. Gozal
Department of Anesthesiology, Hadassah University Hospital, Jerusalem, Israel

E. Gross
Department of Pediatric Surgery, Hadassah University Hospital, Jerusalem, Israel

Y. Sherman
Department of Pathology, Hadassah University Hospital, Jerusalem, Israel
Introduction

Percutaneous image-guided needle biopsy has been slower to gain acceptance in children than in adults where it is regarded as the standard clinical practice for diagnosing suspicious masses [1–8, 9]. Possible reasons are the use of sedation for such biopsies and the similarity of cytological appearance of some pediatric tumors, which require large tissue samples [1, 4, 10]. In the past, malignant conditions in children were primarily diagnosed by histopathologic techniques performed on specimens obtained by surgery or open biopsy [4, 11]. However, recent improvements in diagnostic imaging and newer techniques in molecular biology have permitted accurate diagnosis and staging of many types of tumors in children using percutaneous image-guided core-needle biopsy (PCNB) [1, 11, 12]. The technique is relatively simple, minimally invasive, inexpensive with a low rate of complication, and is highly accurate [1–4, 11, 13, 14]. We report our experience with percutaneous image-guided needle biopsy [core-needle biopsy and fine-needle aspiration biopsy - (FNAB)] in the pediatric population, assess its clinical use, efficacy and limitations, and outline its impact on management in a variety of clinical situations.

Materials and methods

Between 1988 and 1998, we performed 69 image-guided percutaneous biopsies in 57 children. The age of the children ranged from 4 days to 14 years (mean 5.6 years). There were 29 boys and 28 girls. Biopsies of diffuse liver or renal disease were not included in this study. Informed consent was obtained from all parents, and normal coagulation parameters were required prior to the biopsy. Percutaneous image-guided biopsies were performed under sonographic guidance in 44 cases and CT guidance in 25 cases. All the biopsies were performed by an experienced senior radiologist. Sixty-two biopsies were core-needle biopsies and 7 biopsies were FNAB. Prebiopsy imaging was performed to determine the margins of the tumor, degree of vascularity and the presence of necrotic areas in the lesion. Thirty-nine US-guided biopsies were performed under general anesthesia (halothane inhalation and fentanyl IV for analgesia 1 mg/kg) at the same time of central venous catheter placement in the operating room. The radiologist provided and performed the ultrasonographic guidance and the biopsy in the sedated patient. Twenty-five biopsies were performed with deep sedation (propofol 1 mg/kg induction dose, followed by a continuous drip of 3 mg/kg per h) and 5 were performed with local anesthesia (lidocaine 2%). All children who underwent the procedure under general anesthesia were hospitalized and monitored for 24 h in the Pediatric Surgery Department. A variety of needles was used, including 18-to-20-gauge core-biopsy cutting edge Turner needles (Cook Corp. Bloomington, Ind.), for CT-guided biopsies and 16-to-18-gauge cutting-edge needles combined with an automated biopsy device (Biopry Gun, Mianan PROMAG 2.2) for the sonographic-guided biopsies. The number of passes was determined according to the amount of tissue obtained with an average of 3–6 passes for one biopsy session. Biopsy material was sent for histologic examination and complimentary cytologic examination. In some cases further material was sent to cytogenetics and for NMYC evaluation.

Pathology reports of malignancy were defined as diagnostic if the report read ‘suggestive of,’ ‘consistent with,’ or ‘diagnosis of malignancy.’ They were defined as non-diagnostic if the report read ‘no cellular yield,’ ‘no malignant cell noted,’ or ‘inadequate material.’ For benign disorders, the results were defined as ‘diagnostic’ if a specific diagnosis was provided.

Results

There were 50 malignant lesions, 12 benign lesions (2 infective lesions). Table 1 summarizes the results. The procedure was well tolerated in all patients, and there were no complications related to the biopsy or sedation.

In 55 (55/62) 88.7% lesions, image-guided needle biopsy was diagnostic. In 7 (7/62) 11.3%, the biopsy was non-diagnostic and the diagnosis was made by surgery.

Seven children underwent a repeated image-guided core-needle biopsy (five for Wilms’ tumor and two for neuroblastoma) that was diagnostic in all cases. The accuracy of image-guided core-needle biopsy alone in the diagnosis of solid malignant tumors was 98%, and percutaneous image-guided needle biopsy (core needle and FNAB) of malignant lesions was diagnostic in 47 out of 50 (94%) of solid tumors. In one patient, PCNB of the mass under CT guidance was non-diagnostic, and because of the location of the tumor it was not possible to perform the biopsy under US guidance, since it necessitated passage through major vessels. The patient underwent an excisional biopsy of a mesenteric lymph node, which was diagnostic for neuroblastoma. The other two were negative FNAB for lymphoma. One was in a patient with cervical lymphadenopathy; the biopsy was negative and the diagnosis was made by an excisional biopsy. The second was in a patient with cervical lymphadenopathy after liver transplantation; the FNAB could not rule out malignancy, and on excisional biopsy the pathology was consistent with post-transplantation lymphoproliferative disorder (PTLD).

Malignant diagnoses of solid tumors were confirmed after subsequent oncologic treatment by surgical excision of the residual tumor mass. Forty-six biopsy procedures were for lesions in children with no previous history of cancer and the remaining four were obtained to evaluate new lesions in children with prior malignancies.

There were 12 benign diagnoses that were confirmed either by clinical follow-up of 6 months to 2 years’ duration (n = 7) or further excisonal biopsy (n = 5) (Table 2). Biopsy sites included the kidneys (21), retroperitoneum (13), liver (8), abdomen (5), pelvis (3), chest, neck and soft tissues (6 biopsies each), and axilla (1 biopsy).

There were seven FNAB, six biopsies from neck lesions and one from lung nodules. Five were not diagnos-