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Comparison of Needle Size in Pediatric Renal Biopsy with Sono-Guided Percutaneous Automated Gun Technique[1]

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Purpose : To compare the efficacy of a 20-gauge and an 18-gauge needle in sono-guided percutaneous automated gun biopsy for establishing the specific diagnosis of renal parenchymal disease in pediatric kidneys.

Materials and Methods : In 60 pediatric patients with renal parenchymal diseases, percutaneous sono-guided gun biopsy was performed by an experienced radiologist. In two groups of 30 patients, regardless of their age, two needle passes were performed, using alternately an 18-gauge or a 20-gauge biopsy needle. The core of renal tissue thus obtained was examined with light, immunofluorescent or electron microscopy by the renal pathologist. The mean number of intact glomeruli of whole tissue core per biopsy, as seen on the light microscopy, and post-bioptic complications were compared between the two different needle size groups.

Results : The number (mean $\pm$ 1 standard deviation) of glomeruli obtained per biopsy was 17 ± 8 in the 18-gauge needle group, and 14 ± 5 in the 20-gauge group. Between two groups, there was no major post-bioptic complication requiring specific treatment, nor a statistically significant difference in the frequency of minor complications.

Conclusion : Even though more glomeruli were obtained with an 18-gauge needle, the number obtained with a 20-gauge needle also permitted adequate pathologic examination. Both an 18-gauge and a 20-gauge needle may thus be suitable for renal biopsy in pediatric patients.

Index Words : Kidney, biopsy
Ultrasound(US), guidance
Children, genitourinary system
Biopsies, technology

To establish the specific diagnosis of renal dysfunction in certain adult or pediatric patients with renal parenchymal disease and in some patients with renal allografts, percutaneous renal biopsy is mandatory. Unlike most radiographically guided biopsies of focal masses, biopsies for medical renal disease require large intact cores of tissue for pathologic evaluation. An adequate specimen should contain a significant number of intact renal glomeruli, and five is generally agreed to be the minimum for adequate pathologic assessment (1).

Since the advent of automated biopsy gun apparatus, sono-guided renal biopsy using this device has been a well accepted technique for the diagnosis of medical renal disease not only in adults, but also in pediatric patients. There is considerable controversy concerning the appropriate size of needle for use in renal biopsy mainly in adults, though it is usually said that the rate of complications, including renal damage, decreases when needle size is reduced ; this, however, is often at the expense of a lower diagnostic yield (2-4). Poster et al (2) found that since the renal glomeruli are more tightly packed in children, the

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number of glomeruli provided by a smaller-bore biopsy needle (18-gauge) was in fact equivalent to the number found in a larger-bore (14-gauge or larger) sample from an adult kidney. There is, however, no published literature in English dealing with smaller-bore needles thinner than 18-gauge used in sono-guided renal biopsy in pediatric patients. The purpose of this study was to compare the efficacy of a 20-gauge and an 18-gauge needle in sono-guided percutaneous automated gun biopsy performed for the purpose of establishing the specific diagnosis of renal parenchymal disease in pediatric kidneys.

Materials and Methods

During the previous three years, consecutive sono-guided renal biopsies were performed in sixty pediatric patients (male to female ratio=27 : 33) with clinically suspected renal parenchymal diseases. To compare the efficacy of two different-sized needles, either an 18- or a 20-gauge needle equipped with the automated biopsy gun apparatus was used alternately in our patients according to the sequence of the date of their admission to the hospital, and regardless of their age, which ranged from 6 months to 14 years (mean 6.3 years). Pathologic reports and medical records were reviewed.

After patients were sedated (chloral hydrate 1cc/kg p.o. or ketamine hydrochloride 0.03cc/kg intravenous injection) and anesthetized locally (1% lidocaine), the optimal biopsy site (usually the lateral aspect of the lower pole of the left kidney) was selected in prone position by an Ultramark 9 HDI (ATL, Wash., USA) 4−7 MHz convex ultrasonic probe. The selected area of needle entry was prepared, and a small skin incision was made; if possible, the patients's respiration was suspended. Each percutaneous renal biopsy was performed by an experienced radiologist using an automated biopsy gun (Manan medical products, Northbrook, Ill., USA) under ultrasonographic guidance. The radiologist performed the biopsy with his right hand, leaving the left free for maneuvering the ultrasonic probe (i.e. bi-manual technique). The needle, 10 cm long with a 17 mm side notch, was advanced obliquely using lateral to medial approach until the tip was seen pushing on the kidney or just penetrating the renal capsule; the biopsy was then performed with two needle passes in each patient.

A renal tissue core (usually 1−2cm×1mm) was placed on saline moistened gauze and sent to a renal pathologist. Each specimen was examined on light, electron and immunofluorescent microscopy; the exact number of intact glomeruli within the whole volume of the retrieved tissue cores, excluding those that were incomplete or deformed, was counted. The mean number of intact glomeruli seen on light microscopy within the whole volume of tissue core per biopsy (i.e. the numbers of intact glomeruli within the whole volume of the tissue core of two biopsies divided by two) was compared between 18- and 20-gauge needle groups. To evaluate post-bioptic complications, follow-up renal ultrasonography and clinical evaluation were performed in all patients (mean follow-up period=3 months). The frequency of post-bioptic complications was also compared between the two biopsy needle groups.

Results

Biopsy results for the two needle groups are summarized in Table 1.

The number (mean±1 standard deviation) of obtained glomeruli per biopsy was 17±8 in the 18-gauge needle group, and 14±5 in the 20-gauge needle group.

In all patients, specimens were adequate and the numbers of glomeruli were sufficient, and pathologic diagnoses were thus possible. The least number of glomeruli obtained was nine, in four patients (two with an 18-gauge needle and the other two with a 20-gauge needle). Pathologic diagnoses of the 60 patients were as follows: Ig A nephropathy (n=5), mesangial lupus nephritis (n=3), focal proliferative lupus nephritis (n=2), diffuse proliferative lupus nephritis (n=2), membranous lupus nephritis (n=2), minimal change glomerulonephritis (n=14), membranoproliferative glomerulonephritis (n=7), mesangial proliferative glomerulonephritis (n=5), diffuse proliferative glomerulonephritis (n=11), focal glomerulosclerosis (n=4), and membranous glomerulopathy (n=5).

No major post-bioptic complications were found

Table 1. Comparison of Results of Renal Biopsy in Two Needle Groups

	18-gauge Group	20-gauge Group
No. of Patients	30	30
No. of Glomeruli (mean±1 standard deviation)	17±7	14±4
Major Complication	0	0
Minor Complication (mild flank pain, hematuria)	6	4

either ultrasonographically or on clinical examination during the follow-up period of 1—5 months. Minor complications such as mild left flank pain after renal biopsy and traces of gross hematuria that subsided spontaneously were noted in ten patients (six in the 18-gauge group, and four in the 20-gauge group).

Discussion

Since it has direct impact on patient care, percutaneous renal biopsy is an important diagnostic tool for the evaluation of renal parenchymal diseases (2, 5—7); in order to divert the needle into the lateral renal cortex, it is usually performed with sonographic guidance. For the diagnosis of the renal parenchymal disease on light, electron or immunofluorescent microscopy, an adequate amount of renal tissue core, with as many glomeruli as possible, is required. The goal of sono-guided percutaneous renal biopsy, therefore, is to obtain sufficient renal parenchyma, including a number of intact renal glomeruli, for the evaluation of medical renal disease (8).

In renal biopsy, the rapid-fire automated biopsy gun, usually under the guidance of ultrasonography (3, 4, 7—14), has recently become popular. In a number of studies comparing conventional and biopsy gun techniques, the latter has been proved superior in terms of adequacy and quality of specimens. These include fragmentation and "crush" artifacts of the specimen, the number of passes required to obtain adequate specimens, rate of complications, applicability, feasibility, learning curve, procedure time, patient comfort, and average length of stay in hospital (2—4, 10—12). The automated biopsy gun allowed us to perform the biopsy with one hand, leaving the other free for maneuvering the ultrasonic transducer. This bimanual technique is not common, particularly for those such as nephrologists not skilled in ultrasonography. The kidney is often localized using ultrasonography alone, with intermittent checks for needle placement. Our bi-manual technique allowed better real-time control of the placement and depth of the needle, so was considered to be a safer technique. In pediatric patients, the biopsy gun has been used to a limited extent, and in the literatures in English there are few reports of the results of sono-guided automated gun biopsy in cases of pediatric renal parenchymal disease (2, 15, 16). Because of small body surface area, small size of the kidney, and decreased cooperation in pediatric patients, a meticulous approach may be needed; this would include a smaller-bore biopsy needle, fewer needle passes, shorter procedure time, and strong sedation.

The biopsy material for the renal pathologist must be sufficient for the diagnosis of renal parenchymal disease; as large a tissue sample as possible, with one that contains at least 10 glomeruli, is thus required (1, 17). Poster et al (2) obtained a minimum of ten glomeruli in tissue specimens taken from six of seven patients (86%). They stated that in pediatric renal biopsies, a smaller-bore biopsy needle in fact provided the equivalent number of glomeruli found in a larger-bore sample from an adult kidney, since in children the glomeruli were more tightly packed. Veiga et al (15) were successful in 24 of 25 biopsies in pediatric patients with renal parenchymal disease. These authors and Poster et al., all used an 18-gauge needle with a 17-mm side notch. In a series of 119 biopsies in 109 pediatric and adolescent patients, Jorulf et al (11) used adjustable automated biopsy device. They used an 18-gauge needle for five patients less than one year old and a 16-gauge needle in all other patients, and retrieved diagnostically adequate tissue in 118 biopsies (99.2%). They stated that on histologic examination, 90% (106 of 118) of biopsies had more than ten glomeruli in the largest specimen area. In 93% (56 of 60) of our biopsies, more than 10 glomeruli per biopsy were obtained in the whole tissue core area.

In spite of many studies particularly among adults, there is considerable controversy concerning adequate needle size in renal biopsy (2—4, 11). In several publications dealing with different needle sizes used during various biopsy techniques, it is stated that complication rate decreases in line with reduced needle size (2—4). This reduction, however, is often at the expense of a lower diagnostic yield (3, 18), and some investigators emphasize that a satisfactory diagnostic yield using smaller needles is dependent on experience (8, 17). For adult native or transplanted kidneys, Lee et al (19) compared the number of retrieved glomeruli and post-bioptic complications between a 14-gauge Vim-Silvermann needle biopsy group and a 16-gauge automated gun biopsy group. The numbers of glomeruli per biopsy in native/allograft/total kidneys were $31.5 \pm 20.9/21.7 \pm 14.3/30.3 \pm 20.5$ in the former group and $27.5 \pm 16.3/14.6 \pm 10.4/21.5 \pm 15.2$ in the latter, respectively. They concluded that although the number of retrieved glomeruli was significantly higher in the 14-gauge Vim-Silvermann needle biopsy group, the number in the 16-gauge automated gun biopsy group was adequate for pathologic interpretation. To our knowledge, however, there is no published study in English dealing with the use of smallerbore needles thinner than 18-gauge in sono-guided renal biopsy in pediatric patients; we therefore attempted to compare the efficacy of an 18- and a 20-gauge needle. In 30

patients, we used the former, and 17±7 glomeruli were obtained; and in the other 30 patients, using the latter, 14±4 were obtained. These numbers were adequate for pathologic interpretation.

Minor complications have been reported after percutaneous renal biopsy; these include macroscopic hematuria for more than 12 hours and/or clinically suspected or sonographically proven subcapsular or perirenal hematomas, which spontaneously resolved without further intervention or the need for transfusion (9). Among seven pediatric patients, Poster et al (2) reported one with trace hematuria. Christensen et al (10) reported that the complication rate seemed to be independent of the number of needle passes during each biopsy procedure: it was 15% in patients with three or four passes, 18% in those with one pass, and 25% in those with two. In our study, no major complications requiring specific treatment were found following biopsy. Five to eight hours after renal biopsy, only ten patients (17%; six in the 18-gauge group and four in the 20-gauge group) complained of mild left flank pain and traces of gross hematuria, but these subsided spontaneously. There was no statistically significant difference in frequency of post-bioptic complications between our two needle groups.

In conclusion, even though more glomeruli were obtained with an 18-gauge biopsy needle, the number obtained with a 20-gauge needle also permitted adequate pathologic examination. Not only an 18-gauge needle, but also a 20-gauge, may be efficient in sono-guided percutaneous automated gun biopsy for the diagnosis of renal parenchymal disease in pediatric patients. A 20-gauge needle, rather than one which is 18-gauge or larger, may be useful for experienced radiologists especially, in neonates, infants, and children of low body weight.

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초음파 유도하의 경피적 자동총 기법을 이용한 소아 신장 생검에서 생검침 크기의 비교[1]

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목 적 : 초음파 유도 하의 경피적 자동총 신장 생검법을 이용한 소아 신 실질 질환의 특별 진단에 있어서 18-게이지 생검침과 20-게이지 생검침의 효용성을 비교하고자 하였다.

대상 및 방법 : 신장 실질 질환을 가진 60명의 환아를 대상으로 경험이 많은 한 방사선과 의사가 초음파 유도 하에 자동총 생검을 사용하여 경피적 생검을 실시하였다. 환아를 연령에 관계없이 각각 30명씩 두 군으로 나눈 후 18-게이지와 20-게이지 생검침을 교대로 사용하여 각 환자에서 두 번씩 생검을 실시하였다. 이렇게 얻어진 신장 조직 절편을 신장 병리학자가 광학, 면역 형광 및 전자 현미경으로 검사하였다. 생검침 크기가 다른 두 군에서 광학 현미경 검사상 조직 절편 전체의 매 생검 당 얻어진 사구체의 평균 숫자와 생검 후에 발생한 합병증을 서로 비교하였다.

결 과 : 매 생검 회수 당 얻어진 사구체의 수(평균±1 표준 편차)는 18-게이지 침을 사용한 30명에서 17±8개, 그리고 20-게이지 침을 사용한 30명에서 14±5개이었다. 신장 질환 환아의 양군에서 생검 후에 특별한 치료를 요하는 중요한 합병증은 발생하지 않았고, 통계적 의의가 있는 경미한 합병증의 발생 빈도 차이도 없었다.

결 론 : 비록 18-게이지 침으로 더 많은 수의 사구체를 얻었지만 20-게이지 침으로도 병리학적 검사에 충분한 수의 사구체를 얻었기에, 18-게이지뿐만 아니라 20-게이지 생검침도 소아 환자의 신장 생검에 적절히 사용될 수 있을 것이다.

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