ABSTRACT.

OBJECTIVE: To evaluate the role and safety of ultrasound (US) guided percutaneous biopsy in the diagnosis of digestive tract lesions, when the lesions are not suitable to biopsy by endoscopy and safely reachable by US.

MATERIALS AND METHODS: We performed 42 biopsies in 41 patients aged 14-81 years (mean 57.5 years). The lesions showed a pseudokidney sign in 27 cases and mass appearance in the remaining 15 cases. Biopsies were carried out under real-time US guidance using graded compression, with a 3,5-5 MHz microconvex transducer. In 39 biopsies core specimens were obtained with an 18G automatic needle gun; in 32 of these cases fine needle aspiration biopsy was obtained with a 22G needle in 28 cases and with a 21G in the other 4 cases. In the remaining 3 cases a coaxial technique with 20G and 22G for cytology were used.

RESULTS: In 95,2 % (40 / 42) of core biopsies performed a specific diagnosis was obtained. A positive diagnosis was obtained in 45,7% (16 / 35) of fine needle aspirations. The lesions were localized from pharynx to the sigmoid colon. The patients had malignant lesions in 28 cases and benign in 13 cases. Only one serious complication, bile peritonitis, was observed.

CONCLUSION: Percutaneous biopsy under US guidance can be used safely and efficiently to diagnose digestive tract lesions which can be visualized on US and which are not accesible endoscopically.

INTRODUCTION.

Percutaneous biopsy under imaging guidance is a very common procedure performed by radiologists and it is the usual method of obtaining tissue diagnosis in abdominal organs. This procedure is performed in most body locations, mainly in abdominal solid organs as liver, kidney or pancreas (1, 2). Surgical biopsies are rarely performed.

The imaging modality chosen for biopsy guidance depends on the radiologist's personal experience and preference. Improved resolution of current real-time equipment, particularly electronically focused phased-array transducer designs, together with the new cutting needle designs, have made ultrasound (US) competitive with computed tomography (CT), if not superior in some situations (2). US as imaging modality for biopsy guidance is gaining acceptance (2) and is being used in locations previously reserved for CT such as retroperitoneum, mediastinum, lung, pleura and skeleton (3). However, biopsies in the digestive tract are practically always performed by endoscopy, except in some cases in which for some reason the lesion can not be reached by endoscopy (4). In these cases, the biopsy is usually performed by laparoscopy or open surgery.

The objective of this paper is to report our experience in sonographically guided biopsies of digestive tract, and to determine the effectiveness and safety of this technique.

MATERIAL AND METHODS

A retrospective review of all patients undergoing sonographically guided percutaneous biopsy of digestive tract over a period of 5 years was performed in three Community Institutions. 41 patients were biopsied (22 male, 19 female), ranging in age from 14 to 81 years (mean 57.5 years) a total of 42 biopsies. All patients, except one, had a presumptive diagnosis of digestive disease in clinical and imaging studies, in many cases including endoscopy. The exception was a pediculate gastric leiomyosarcoma presented as an abdominal mass of uncertain anatomical origin in a 66 year old man (case 11). All the remaining cases the digestive origin was known according to the barium studies, CT or US. All the patients were referred endoscopic biopsy was not feasible. The reason for which the endoscopic biopsy were not feasible are shown in Table I. The location of the lesions are also shown in table I.

The day before the biopsy, we obtained prebiopsy sonographic scan to determine whether the lesion detected on barium studies or CT could be visualized with US well enough to perform the biopsy. Furthermore, in many cases, we assessed the vascular structures around the target with Doppler color US scan, trying to avoid large vessels in the needle path. The lesions appeared as a thickened gut wall or as hipoechoic mass with echogenic center (Pseudokidney sign) in 26 cases and as eccentric mass in the remaining 15 cases (Table I).

The biopsies were performed using gray-scale equipment in the first 11 biopsies, and with two color Doppler equipment in the remainder , 24 biopsies with model Logiq 400MD (GE Medical Systems, Milwaukee, USA), and model EUB-525 (Hitachi, Tokyo, Japan) in the last 7 biopsies. All the lesions were biopsied using 3.5-5 MHz microconvex transducer with biopsy guide attachment. The procedure was carried out on inpatient basis and the patients were observed at least overnight, to rule out complications. Coagulation parameters and platelet counts were routinely obtained before biopsy. Informed consent was required from all patients after the potential risks and benefits were explained. Patients had to be fasting, at least eight hours before the procedure. An intravenous line was taken as security and sedation was achieved with intravenous administration of midazolam as necessary. No antibiotics were administered.

In 39 biopsies core specimens were obtained with an 18G automatic needle gun: 17 cases with Biopince (Sollentuna, Sweden), 12 with Autovac (Karlsruhe, Germany) and 10 with Monopty (Govinton, USA), for histological diagnosis. In 32 of those biopsies, we added fine-needle aspiration for cytological analysis; 28 with 22G Chiba needle and 21G in the other 4 cases. In the remaining 3 biopsies we used coaxial technique with 20G Chiba needle for histological assessment and 22G for cytology.

Percutaneous biopsy was performed by two radiologists, one held the transducer while the second manipulated the needle. The first radiologist was seeking the shortest and safest path to the target. In abdominal lesions, we used the graded

compression, by pressing the transducer steadily and progressively, to separate the normal bowel loops and to have an optimal view of the lesion.

Once the needle route was chosen, using aseptic technique we infiltrated the path, skin through peritoneum, with 5-10 cc of lidocaine with a 22G spinal needle through the biopsy guide attachment. In pseudokidney lesions we performed the biopsy tangentially planning that the needle path through the hypoechoic rim representing the pathologic layer, and avoiding traversing the echogenic center that corresponded the mucosa and lumen. In eccentric masses the samples were taken from the solid areas.

In fine needle biopsies the needle tip was observed advancing into the lesion on real-time. After removing the stylet, a 10-20 cc syringe was connected to the needle. Tissue sampling was performed with a pushing and turning motion while maintaining 5-20 cc continuos suction, depending on the amount of blood aspirated. The material obtained was placed on 4-6 slides and particulate fragments were placed in biopsy flasks with formaldehyde for histologic study. The slides were smeared and rapidly placed in alcohol for cytologic analysis. Finally, core biopsy was performed under real time guidance and the specimen placed in formaldehyde.

No cytopathologist was present during procedures to determine if adequate sample was obtained and to provide a preliminary interpretation. For each patient, one or two needle passes were made for either cytological or histological diagnosis, according to the macroscopic aspect of the sample.

RESULTS

In 95,2 % (40 / 42) of the core biopsies a specific diagnosis was obtained that determined a medical, surgical treatment or expectant attitude, such as in a gastric leiomyoma (case 7). In 45.7% (16 / 35) of fine-needle aspiration biopsies, sufficient material to provide a diagnosis, was obtained. In general the diagnosis were less specific than the histologic diagnosis, no final diagnosis were obtained with cytological specimens exclusively. These data are shown in the table I.

The two false negatives belonged to the same patient, a 70-year old man previously diagnosed of non-Hodgkin lymphoma in total remission (case 41), at follow-up a pseudokidney imaging was observed in CT-scanner located in colon transverse, in the first biopsy both cytologic and histologic study were no able to provide an specific diagnosis and the biopsy was repeated with the same result, at surgery an adenocarcinoma was found, we have not explanation for this repeated failure.

Most biopsies were well tolerated. One patient, with a duodenal leiomyosarcoma (case 22), had one pass performed with coaxial technique, through the gallbladder. In the following hours the patient experienced acute abdominal pain. US scan showed free peritoneal fluid. Percutaneous drainage demonstrated bile in the peritoneal cavity. Percutaneous cholecystostomy was performed with total recovery. In the cholangiogram performed through the cholecystostomy an extrinsic stricture in the distal common bile duct was found. We believe that the biliary obstruction, was the cause of the bile leak. Seven patients had moderate abdominal pain which disappeared spontaneously without any treatment.

In 8 cases fragments of mucosae were seen in the core specimen, demonstrating in this way that the mucosae and the lumen were perforated without adverse consequences such as peritonitis or pneumoperitoneum.

DISCUSSION

Histological diagnosis of lesions located in the digestive tract is performed mainly in the course of an endoscopy. However, when the lesion is situated submucosal or between the ligament of Treitz and ileocecal valve, the biopsy may be impossible to obtain. In these cases, so far, laparoscopy or open surgical biopsy have been the usual method to obtain histological confirmation except in extensive mucosal involvement of small bowel in which the peroral capsule is the chosen technique(4).

Ultrasound guided percutaneous biopsy of most of the body organs has achieved worldwide acceptance in daily practice (1,2).However, the use of imaging guidance to biopsy the digestive tract has been anecdotal, due to the good result of the endoscopic biopsy and the general belief that it is a risky technique. Percutaneous biopsies of lesions located in the digestive tube have generally been unintentional when biopsing an abdominal mass of uncertain anatomical dependence (4-6).

US is being used more extensively for evaluation of the digestive tract , not only in tumoral lesions but also in a wide range of situations(7). However, some times this assessment of the digestive tube can be problematic, gas content within the lumen can make visibility difficult and even impossible, intraluminal fluid may mimic cystic masses, and fecal material may create a variety of artifact and pseudotumors. Gut wall pathology creates characteristic sonographic patterns. The most familiar, the target pattern was first described by Lutz and Petzold in 1976 (8) who referred to the pattern as a pseudokidney, in which the external hypoechoic rim corresponds to pathological thickened gut wall whereas the echogenic center relates to residual gut lumen or mucosal ulceration. Some digestive tract diseases present a thickened wall but do not show a perfect concentric target otherwise and eccentric pseudokidney or eccentric mass as in 15 cases of our series. Sener et al (9) reported two intestinal lymphoma that showed pseudokidney sign with luminal dilatation and called this finding hydronephrotic pseudokidney sign, we found this pattern in two cases, however according to other report (10) this sign is not specific for lymphoma and may be observed in nonlymphomatous neoplams, as mesenteric sarcoma and colonic adenocarcinoma or jejunal adenocarcinoma as our case 26. The presence of digestive tract thickened is not specific for any determined disease, even does not represent malignancy (7), in fact, 7 of our 27 cases were benign lesions.

The election of CT or US as imaging guidance for percutaneous biopsy depends, on the radiologist´s experience and equipment availability. However in biopsies of the digestive tract, in our opinion, the US advantages are important. One advantage is the ability of using the transducer as compressive tool for one the radiologists while the second manipulates the needle. The graded compression technique described by Puylaert (13) in the diagnosis of acute appendicitis, produces the following effects: 1) Fixes and immobilizes the lesion, which is very important in lesions that are located in mobile structures. 2) Displaces the normal bowel loops and therefore the abdominal gas , improving the ultrasonic view of the target. 3) Decreases the skin

to lesion distance, decreasing the difficulties of biopsy technique. An other important advantages are the ability to control the needle tip in real time and when using color Doppler to identify vessels without contrast agents. Finally US allows the use of automatic needle guns more easily.

Transversing the digestive tract during percutaneous biopsy is not a contraindication(14). In dogs, Petit et al (15) showed no untoward effects from transgressing bowel with needles and catheter . In our and other authors´ experience(16), there were no problems passing through overlying loops of digestive tract for pancreatic biopsies. Brandt et al (16) performed 269 pancreatic biopsies and the needle passed through the gastrointestinal tract in 66 cases, 41 passes were made through the stomach, 18 cases through the small bowel and seven through the colon. None of the 66 cases mentioned had complications related to the biopsy. The same results have been reported when biopsing other structures as lymph nodes(11, 12). In 8 of our cases portions of the mucosa were identified in the cylinder obtained, without adverse effects for this reason.

Fine needles can usually retrieve an adequate sample for cytological analysis and often retrieve tissue fragments for histologic assessment. Large-bore cutting automatic needles substantially improve the result rate in some instances(14). In addition, the pathologist can easily determine the specific pathologic process, especially in benign situations. Like other authors (14, 17) we usually use an 18G needle in core biopsies because it obtains good specimens, without increasing complications. Although we routinely use both fine needle aspirations biopsy and core biopsy in percutaneously ultrasound guided biopsy because they increase the overall results(17), in these specific type of biopsies according to our results we recommend not to use only fine needle aspiration biopsy.

Papers about ultrasound guided percutaneous digestive biopsies accomplished with 18G cutting biopsy are scarce(18). Only one large series has been published (19); Carson et al (19) reported 46 biopsies but only 10 cases underwent core biopsy after negative fine-needle biopsy. Recently, Tudor et al (20) reported a series of ten cases with 18G needle. Some other papers reported sporadic core biopsies of digestive tract including in wide series(5). Series of digestive tract lesions biopsy performed with fine-needle are more numerous(6).

In conclusion, due to the safety, efficiency and capability of US as a guiding imaging technique for percutaneous biopsy of lesions located in the digestive tract, we recommend this technique when the lesion is seen on US and it is not accessible for endoscopic biopsy.

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TABLE I. Summary of biopsies according to site.

Biopsy No/ Age /Sex	Lesion location	US appearance	Cause for no endoscopic diagnosis	Needles	Diagnosis	Management
1/ 49/ M	Pharynx	PsK	Negative	Biopince 18G	Epidermoid Ca.	Surgery

			endoscopic biopsy	Chiba 21G	Carcinoma	
2/ 79/M	Pharynx	PsK	Negative endoscopic biopsy	Autovac 18G Chiba 22G	Epidermoid Ca. Carcinoma	Surgery
3/58/M	Pharynx	PsK	Refusal	Biopince 18G Not perform	Epidermoid Ca. ----------	Surgery
4/14/F	Oesophagus	PsK	Submucosal	Autovac 18G Chiba 22G	Muscular Hypertrophy Negative	Surgery (Infantile Achalasia)
5/58/M	Distal Oesophagus	PsK	Negative endoscopic biopsy	Monopty 18G Chiba 22G	Adenocarcinoma Negative	Surgery
6/58/M	Distal Oesophagus	PsK	Negative endoscopic biopsy	Monopty 18G Chiba 22G	Adenocarcinoma Malignant cells	Chemotherapy (recurrence)
7/42/F	Stomach	Mass	Submucosal	Chiba 20G Chiba 22G	Leiomyoma Negative	Follow-up
8/61/M	Stomach	Hyd. PsK	Submucosal	Monopty 18G Chiba 21G	Large T cell lymphoma Lymphoma	Chemotherapy
9/33/M	Stomach	PsK	Submucosal	Autovac 18G Chiba 22G	Non-Hodgkin lymphoma Non-Hodgkin lymphoma	Chemotherapy
10/39/M	Stomach	Mass	Submucosal	Biopince 18G Chiba 22G	Leiomyosarcoma Spindle cell tumor	Surgery
11/66/M	Stomach	Mass	Unknown digestive origin	Monopty 18G Chiba 22G	Leiomyosarcoma Negative	Surgery
12/77/F	Stomach	Mass	Submucosal	Biopince 18G Chiba 22G	Leiomyosarcoma Stromal tumor	Surgery
13/71/M	Stomach	Mass	Submucosal	Biopince 18G Chiba 22G	Stromal tumor Negative	Surgery
14/52/M	Stomach	PsK	Negative endoscopic biopsy	Monopty 18G Chiba 22G	Adenocarcinoma Negative	Chemotherapy
15/68/F	Stomach	PsK	Oesophageal stricture	Biopince 18G Chiba 22G	Adenocarcinoma Negative	Surgery
16/79/F	Stomach	PsK	Negative endoscopic biopsy	Biopince 18G Chiba 22G	Adenocarcinoma Carcinoma	Chemotherapy
17/56/M	Stomach	PsK	Negative endoscopic biopsy	Monopty 18G Chiba 21G	Adenocarcinoma Adenocarcinoma	Surgery
18/81/F	Stomach	PsK	Refusal	Biopince 18G Not performed	Adenocarcinoma ----------	Chemotherapy
19/66/F	Stomach	Mass	Submucosal	Autovac 18G Chiba 22G	Leiomyoma Leiomyoma	Surgery
20/61/F	Stomach	Mass	Submucosal	Autovac 18G Chiba 22G	Hemangiopericytoma Negative	Surgery
21/61/F	Duodenum	Mass	Submucosal	Monopty 18G Chiba 22G	Leiomyosarcoma Negative	Chemotherapy
22/44/M	Duodenum	Mass	Submucosal	Chiba 20G Chiba 22G	Stromal tumor Negative	Surgery
23/77/M	Duodenum	Mass	Submucosal	Monopty 18G Chiba 21G	Leiomyosarcoma Negative	Surgery
24/55/F	Duodenum	PsK	Previous surgery	Biopince 18G Chiba 22G	Adenocarcinoma Malignant cells	Decease
25/74/F	Jejunum	PsK	Not reachable	Autovac 18G No perform	Eosinophilic enteritis ----------	Decease 2 month later (necropsy)
26/70/F	Jejunum	Mass	Not reachable	Autovac 18G Chiba 22G	Hemangiopericytoma Negative	Surgery
27/66/M	Jejunum	Hyd. PsK	Not reachable	Biopince 18G Chiba 22G	Adenocarcinoma Negative	Surgery
28/70/F	Jejunum	Psk	Not reachable	Biopince 18G Chiba 22G	Adenocarcinoma Carcinoma	Surgery
29/79/M	Jejunum	PsK	Not reachable	Biopince 18G	Non-Hodgkin lymphoma	Chemotherapy

				No perform	----------	
30/52/F	Jejunum	Mass	Not reachable	Monopty 18G Chiba 22G	Leiomiosarcoma Stromal cells tumor	Surgery
31/17/M	Ileum	PsK	Not reachable	Biopince 18G Chiba 22G	Inflammatory infiltrate Acute inflammatory cells	Surgery (Crohn disease)
32/39/F	Ileum	PsK	Not reachable	Autovac 18G	No malignat cell, inflammatory	Improved with specific treatment (Crohn)
				Not perform	----------	
33/27/M	Ileum	PsK	Not reachable	Biopince 18G Chiba 22G	Tuberculous Ileitis Inflammatory	Improved with specific treatment
34/61/M	Ileum	Mass	Not reachable	Monopty 18G Chiba 22G	Non-Hodgkin lymphoma Negative	Chemotherapy
35/33/M	Ileum	Psk	Not reachable	Autovac 18G Chiba 22G	Centrocytic lymphoma Negative	Surgery (bowel occlusion)
36/69/F	Appendix	Mass	Submucosal	Autovac 18G	Mucinous material	Surgery(Mucocele)
				No perform	----------	
37/72/M	Cecum	Mass	Submucosal	Autovac 18G Chiba 22G	Non-Hodgkin lymphoma Negative	Chemotherapy
38/57/F	Right colon	PsK	Not reachable	Biopince 18G Chiba 22G	Adenocarcinoma Adenocarcinoma	Surgery
39/54/F	Sigmoid colon	Psk	Contraindicated	Biopince 18G	Acute Inflammatory infiltrate (Diverticulitis)	Improved with specific
				Not performed	----------	Treatment
40/46/F	Sigmoid colon	Psk	Submucosal	Biopince 18G Chiba 22G	Ulcerative colitis Negative	Improved with treatment
41/70/M	Transverse colon	Psk	Negative endoscopic biopsy	Chiba 20G Chiba 22G	Negative Negative	Repeat percutaneous biopsy (# 42).
42/70/M	Transverse colon	PsK	Negative endoscopic biopsy	Autovac 18G Chiba 22G	Fibrosis infiltrate Negative	Surgery (Adenocarcinoma)

PsK: Pseudokidney, Hyd. PsK: Hydronephrotic pseudokidney, Ca. : Carcinoma

FIGURE LEGENDS.

Figure 1. Fourteen-year-old woman with infantile achalasia and mediastinal mass (case 4). 1A. CT scan shows a 7 cm mass in the posterior mediastinum with oral contrast inside (arrow), representing the esophagus with thickened wall. 1B. Right posterior paravertebral approach sonogram shows pseudokidney sign due to concentric wall thickening of esophagus. Note the needle tip in the hypoechoic rim

(arrow). 1C. Histologic section of percutaneous biopsy shows hypertrophic muscular layer (*) due to infantile achalasia (H & E, X 4).

Figure 2. 71-year-old man with incidental gastric mass found in abdominal US scan (case 13). 1A. CT: Round and well defined mass in the anterior wall of gastric antrum. 1B. US: Hypoechoic, round and well defined mass. Needle tip in the lesion (arrow). 1C. Histopathology of specimen reveals fusiform cells with no cellular atypia in gastric leiomyoma (H & E, X 100).

Figure 3. 61-year-old man with abdominal pain, asthenia, weight loss and epigastric mass (case 8). 1A. CT shows diffuse and asymmetric gastric wall thickening (arrows) with a wide lumen containing oral contrast medium. B. US showing the hydronephrotic pseudokidney sign: circumferencially thickened, hypoechoic gastric wall with hyperechoic mucosal surface associated with distended lumen. Needle tip (arrow). C. Histopathology revels large T cell lymphoma (H & E, x 40). Reprinted, with permission, from reference 4.