Elective Abdominal Ultrasonography by Surgeons at MNH, Dar-Es-Salaam, Tanzania.

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Background: Ultrasound scanning (USS) is an important diagnostic tool in most specialties of surgery. The abdomen is the most commonly scanned region and learning and practicing abdominal USS is the most rewarding. This study was aimed at sharing our experience of elective abdominal ultrasound scanning (USS) done by surgeons at the Department of Surgery, Muhimbili National Hospital (MNH).
Methods: This is a retrospective audit of indications and sonographic findings in 1782 elective scannings done over a 42-month period. All scanning was done by surgeons using Aloka SSD 500 scanner with a 3.5 MHz probe. Average patient scanning time was 5-10 minutes.
Results: The most frequent indications for abdominal ultrasound scanning were abdominal pain (27%), urinary tract symptoms (25%) and abdominal swelling / mass (13%). Overall 47 % of all scanned patients and 58% of those with abdominal pain had normal findings. Of all the patients with abnormal USS findings 42% had abdominal mass. Stone disease was infrequent, seen in 49 (2.7% of all scanned) patients.
Conclusion: Pain is the most frequent reason for requesting abdominal ultrasound scanning but it has a low yield of sonographic findings. Scanning for abdominal swelling/mass gave the highest proportion of abnormal findings. USS of a surgical patient done by surgeons expedites diagnostic workup, shortens hospitalization, facilitates biopsy and may help to avoid diagnostic laparotomy.

Introduction

Ultrasound scanning (USS) has become an important diagnostic tool in most specialties of surgery. Douglas Howry[1] of the University of Colorado Medical Centre developed an ultrasonic scanner in 1948. The first compound scanner, in which the transducer could be placed directly on the skin, was commissioned in 1962. During the last 20 years, rapid development in USS has occurred through the introduction of Gray scale and real time scanning. Intracavitary scanning also substantially increased the potential value of ultrasonography in surgery.

Most body regions can be imaged by USS; some of them may need special techniques. The abdomen is the most commonly scanned region and learning and practicing abdominal USS is the most rewarding. Unfortunately, in some centres USS has earned a reputation for poor reliability because it has been performed by personnel who, as result of insufficient training, perform examinations that are prone to diagnostic errors.

Different opinions exist as to who should perform ultrasound examination: the specialist in the respective clinical field or the radiologist. This depends, of course, on local arrangements and traditions, available equipment and the Ulrasonographic experience and expertise of the various health care cadres. This report is intended to demonstrate the usefulness of USS as a surgeon's tool in a third world setting in which USS is traditionally performed in the Radiology Department by the radiologist.

Patients and methods

Ultrasound services were first deployed in the surgical department at Muhimbili National Hospital in November 2000. Under the arrangement, in-patients and out-patients were scanned on twice a week in a surgical ward side-room fitted for that purpose. Previously patients for USS had to get an appointment from the Radiology Department where waiting times were up to ten days. Our services were made possible courtesy of Mannheim Surgical Clinic in Germany through an academic exchange program between the two institutions through which an USS machine was acquired. The program also provided a three-month training in Germany to a senior surgeon (MW), who already had basic USS training. All scans in this study were performed by him and/or his mentor (MW), or under their direct supervision. The scanning was performed with the ALOKA SSD 500 scanner with a single universal 3.5 MHz convex transducer. On average 15 patients

were scanned each session. A water spray, delivered by nebulizer, was used as acoustic coupling agent. Patients were positioned on an examination table and made to lie down on the back and place their hands above the head. If necessary the position was varied during the examination. For examination of the pelvic organs patients were instructed to drink fluids, 1 litre of water for adults and come for the examination with a full bladder.

All important pathological findings were immediately recorded in a special register and a report of the findings was written to the patient's referring doctor. If a biopsy or placement of tube/catheter was necessary, it was done on the spot under US guidance. A special core-biopsy needle was used for taking histological specimens.

Results

From the time US services became available in the Department of Surgery in November 2000 to May 2004 a total of 1782 patients, 1009 of them males and 773 females, were scanned electively. The majority, 65%, were in-patients from various MNH wards, including General Surgical, Paediatric Surgical and Obstetrics and Gynaecology wards. The rest were outpatients, most being from the surgical clinics. The age and sex distribution of the patients are shown in Table 1. The majority of them (77.9%) were in the age range 20 to 69 years.

A total of 106 patients (5.9%) below age of 10 years were from the paediatric surgical ward. The indications for abdominal USS were as shown in Fig 1. The most frequent reasons were abdominal pain, 472 patients (26.5%), urinary tract symptoms 440 patients (24.7%), and abdominal swelling/mass, 230 patients (12.9%). Patients with malignant disease needing detection of or exclusion of intraabdominal metastasis constituted 224 patients (12.6%) and gynaecologic/obstetric patients were 184 (10.3%of the scanned population). There were also other less frequent indications for performing abdominal USS.

Figures 2 to 5 show the outcome of abdominal scanning in each category of indications. Normal findings overall were obtained in 42 % of the scanned population. However, taking each indication separately, the highest proportion (58%) of normal findings was in those referred due to abdominal pain (Figure. 2) and the lowest (4.8%) was in those with abdominal swelling/mass (Figure 3). Tables show the most frequent pathological findings in abdominal scanning regardless of indication to be masses (42%). These masses could be in the target organ or outside the organ, intra- or retroperitoneal. There were 49 patients with stone disease: 29 with renal stones, 9 with bladder stones, 11 with cholelithiasis (one jaundiced patient with a bile duct stone) Fig. 2 and Fig. 4. US detected intra abdominal metastasis in 22 out of 224 patients with proven malignancy, giving a metastasis rate of 9.8%. The most frequent organs involved by metastasis were liver 13, spleen 3, lymph nodes 4 and ovaries 2.

Urinary tract symptoms were the second most frequent indication for USS. The commonest findings in these patients were prostate enlargement due to malignancy or benign disease (43%) and bladder tumours (21.1%), Fig.4. Patients with Obstetric and Gynecological symptoms constituted 10.3% of our scanned population. The commonest findings in these patients were normal intrauterine pregnancy, ovarian masses and uterine myoma.

Discussion

USS technology is used in almost all fields of Medicine for diagnostic as well as for therapeutic purposes. The equipment is simple to use, the procedure cost effective and can be performed even in places with minimal infrastructure. In areas without mains electric power a generator can be used as a source of electricity and there are now portable US scanners powered by batteries. USS as a diagnostic tool is rapidly becoming widespread even in developing countries. Moreover, USS is also used as a screening tool in surveys in clinical practice as well as in population studies. The versatility and cost effectiveness of USS makes it an ideal diagnostic instrument in the third world setting.

The availability of USS in the surgical wards at Muhimbili has proven to be very useful. It has expedited diagnostic work up of patients in the wards and outpatient clinics, and has shortened hospitalization time and thus saved money. It has facilitated taking of intra-abdominal biopsies and saved patients from unnecessary

diagnostic laparotomies. The scanning is done by a surgeon trained in diagnostic USS. This provides an opportunity to monitor and follow-up the progress of the patient and compare sonographic findings with operative and pathological findings. It was not practical to compile and analyze follow up data in this study because the patients came from so many diverse sources.

The male preponderance (56.6%) of scanned patients can be partly explained by the fact that there were nearly 3 times more males than females in the age group above 59 years, the majority of those males being urological patients. The amount of USS services offered by the surgical department does not reflect the total USS services load at MNH. Larger numbers of patients are examined by the Department of Radiology, which runs services on a daily basis. However, the pattern of requests, indications and pathological findings in this audit probably reflects the MNH situation as a whole.

To our knowledge there are no published studies on the outcome of clinical USS in East Africa. It is important for clinicians to be familiar with the indications for USS and the pattern of pathological findings seen in our setting, which may be different from those of other regions of the world.

The most frequent indications for abdominal USS scanning from this study were abdominal pain (27%), lower urinary tract symptoms (25%) and abdominal swelling/mass (13%). Of patients scanned purely due to abdominal pain the majority (58%) had normal findings. The reasons for this are several: Conditions like peptic ulcer, small polyps or infection/inflammation in the stomach or intestine are not readily detectable by USS. Abdominal pain may be caused by physiological changes or could be neuronal in origin; USS detects only anatomical changes. The most frequent pathological findings in those patients referred purely due to abdominal pain were renal infections, hydronephrosis and polycystic kidney disease (13%), followed by inflammation. The inflammatory conditions included acute appendicitis, abscesses and pelvic inflammatory disease.

Contrary to common belief, sonomorphological criteria that distinguish an inflamed from a normal appendix make USS an important tool in diagnosis of appendicitis. USS has been found to be a valuable tool in confirming as well as in ruling out acute appendicitis[2, 3].

Intestinal USS has also proved to be a valuable tool in diagnosing bowel obstruction and inflammatory bowel diseases, especially when bowel wall thickness exceeds 7mm[4.] Renal pathology like hydronephrosis, polycystic disease, isolated renal cyst and renal stones were found in a substantial proportion of those who came specifically with loin pain.

The second most frequent indication for abdominal USS in this series was Urinary tract symptoms, most being lower urinary tract symptoms. The important pathological findings in these patients were prostate enlargement, both benign and malignant, bladder tumors and the changes due to urinary tract schistosomiasis. Suprapubic imaging of the prostate correlates with that of transrectal imaging but is limited by the pubic bone[5]. Transrectal imaging, which is currently not available at our department, is appropriately used to assess prostate size, to identify focal abnormalities, and to guide prostate biopsies[6,7,8]. USS of the bladder easily detected bladder tumours in our series of patients who normally present with advanced disease. Affection of upper urinary tract in the form of hydronephrosis and renal tumors was also seen. This made intravenous urography (IVU) unnecessary in some cases.

The third most frequent reason for requesting abdominal USS was complaint of abdominal swelling or presence of an abdominal mass. Thirteen percent of patients referred to us for scanning were referred because of abdominal swelling or a palpable mass. Out of 230 patients scanned due to abdominal swelling or mass, only 11 had normal findings. This gives a sensitivity of 95.2% of detecting a palpable abdominal mass by USS in our hands. The reason to scan abdominal masses is not merely to confirm the presence of a mass but more importantly to localize the mass and predict the pathology. The localization of masses was 39 (59%) organ-confined and 27 (41%) arising out of and involving the organ in question. Localization of the masses could also be categorized according to abdominal compartment involved as abdominal wall, peritoneal cavity, mesentery or retroperitoneum. Studies done elsewhere[9,10] have shown that USS could detect masses in 68% of scanned patients,

correctly identified the origin in 97% of cases and was able to predict the pathology and to guide further management of the patients.

Prediction of pathology is neither easy nor straightforward. It involves putting together the sonomorphological findings with clinical features. Definitive Pathology can only be given by taking biopsy, preferably under direct USS guidance. Percutaneous biopsy of abdominal and retroperitoneal masses under USS guidance is a safe and accurate method of obtaining a histological diagnosis[11]. The results obtained have a considerable effect on clinical management. In 15 cases where an USS-guided biopsy was taken, the procedure was 100% successful and without complications.

Inflammatory masses, Lymphoma and lymphadenopathy were the commonest pathologies giving rise to abdominal masses. This is not a surprising finding in this age of HIV pandemic where the incidences of abdominal tuberculosis and lymphoma have considerably increased. Although unequivocal diagnosis of abdominal tuberculosis can only be made by culture and histological findings, USS findings have been reported to be important tools in the diagnostic process for abdominal tuberculosis[12]. Lesions seen in abdominal tuberculosis are ascites, peritoneal thickening and nodularity, intestinal wall thickening and conglomeration,, lymphadenopathy and *solid organs tuberculosis*[13,14]. The need to consider TB and Lymphomas as differential diagnosis in patients with obscure abdominal symptoms and masses, especially with multiple organ involvement is stressed

USS is the most cost effective imaging technique for detecting abdominal metastasis in patients with malignant disease[15]. Screening tests for metastasis at MNH include liver function tests, chest X-ray, skeletal survey and abdominal USS. Of the 224 patients with malignancy, USS could detect 22 (9.8%) patients with abdominal metastasis. Only positive USS findings of metastasis are sufficiently reliable to be used for therapeutic decisions in patients with malignant disease while a negative result is by no means sufficient to exclude metastasis.

Taking into account cost effectiveness, simplicity and patient tolerance, USS is the test of choice for the detection of intra abdominal metastasis.

The majority of patients referred to surgeons with jaundice have surgical jaundice. Abdominal USS scanning is invaluable in the evaluation of surgical jaundice. A high degree of accuracy and non invasiveness makes USS the primary imaging tool in the differential diagnosis of obstructive jaundice [16].

Our experience with USS in emergencies is limited, as our service is mostly confined to elective patients. Generally the service is not available outside official working hours. Focused abdominal USS is performed in patients with blunt abdominal trauma and is used to check for free fluid, pneumoperitoneum, detect certain solid organ injuries and more recently, has been used to evaluate thoracic trauma[17].

The scope of USS services of the Department of Surgery at MNH needs to be widened to include imaging of other body regions and specialties. Other applications of interventional USS, both diagnostic and therapeutic, should also be introduced. This entails improving the facility and having a variety of probes.

Conclusion:

It has been shown in this as well as other studies[18] that USS performed by surgeons has numerous advantages. In the MNH experience USS performed by the surgeon rather than the radiologist in Radiology Department reduced waiting time and duration of hospitalization and consequently the cost of care. The examination is more readily combined with US-guided interventional procedures. It is recommended that US S training be incorporated into the curriculum of surgical training.

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