The value of ultrasound as a primary imaging modality in detection of ileocecal Crohn's disease

Dr. Eaman Muhsin Ali, FICMS.
Radiology dept. colloge of medicine, Al- kufa university.
Dr. Saad Humood Al-Lamie, MBChB, HDOS, AL-Hakeem hospital. Surgery dept.

أهمية استخدام السونار كفحص أولي في اكتشاف متلازمة كرونز في الأمعاء

الخلاصة:

غالبا يستخدم السونار كفحص شامل أولي في كل المرضى الذين يشكون من علامات أمراض البطن. الغرض من هذه الدراسة هي تقييم هذه الإمكانية في الاكتشاف المبكر لمرض كرونز الأمعاء في منطقة أللفائفي والأعور. استرجاعيا، قمنا بدراسة كل المرضى المشخصين بمتلازمة كرونز خلال الفترة ما بين سنة ٢٠٠٠-٢٠٠٦.

التشخيص النهائي كان يعتمد على المتابعة السريرية، الزرع النسيجي، الجراحة، والسونار والفحوصات التصويرية الأخرى. تم تسجيل الإحالات، وما هي الاحتمالات السريرية الأولية، وما هو أول فحص تصويري قد تم. كما تم اخذ المعلومات من أول سونار للمريض، تم تسجيل المعلومات أيضا المسجلة على صور السونار المأخوذة للمريض. العدد الكلي للمرضى ٤٧ مريض (٢٠ عدد الذكور و٢٧ عدد الإناث) المدى العمري كان ١٧-٧٠ سنة. في كل المرضى كان أول فحص تصويري هو السونار.

بالاعتماد على السونار فقط تم التشخيص النهائي لمرض كرونز في أللفائفي والأعور في ٣٥ مريض من ٤٧، عشرة من العدد الكلي كان تشخيص كرونز احتمالي فقط ، بينما باقي الاثنان من العدد الإجمالي كان فيها التشخيص خاطئ. في ٢٨ من المرضى كان الطبيب المرسل لم يذكر مرض كرونز عند طلبه السونار، ثمانية منهم لهم علامات مشابهة لالتهاب الزائدة الدودية فكان التشخيص في السونار قد منعت من إجراء عملية غير ضرورية للمريض. في حال استخدام السونار كأول فحص تشخيصي تصويري في كل مرضى الآم البطن الغير نموذجية لاسيما تلك التي تماثل التهاب الزائدة الدودية، يعتبر فحص معتمد ومقبول لتشخيص متلازمة كرونز، لأنه يمكن أن يمنع كل من العملية الغير ضرورية ويمنع التأخير في علاج المريض الذي لا يحتاج إلى تداخل جراحي.

Abstract:

Ultrasound (US) is used as an initial screening procedure in all patients with abdominal symptoms. The purpose of this study is to assess the use of this policy in the detection of ileocecal Crohn's disease. We retrospectively studied all patients with a new diagnosis of ileocecal Crohn's disease over the period from 2000-2006. The final diagnosis was based on clinical follow-up and pathological, surgical, US, and other radiological findings. We noted who referred the patient to the radiology department, what the initial clinical diagnosis was, and what the first imaging study was. US diagnosis was determined from the initial US report and US findings were registered from the images. There were a total of 47 patients (20 male, 27 female) with a mean age of 30 years and a median age of 27 years (range 17-70 years). In all patients the initial imaging study was an abdominal US. Using US, a confident diagnosis of ileocecal Crohn's disease was made in 35 of the 47 patients, Crohn's disease was suggested among the differential diagnosis in 10, and an incorrect diagnosis was made in 2 patients. In 28 of 47 patients, the referring physician did not consider Crohn's disease when requesting the initial US examination. In eight patients with appendicitis-like symptoms, the US findings strongly influenced the decision to refrain from operation at that time.

US, when used as a low-threshold diagnostic procedure, is a reliable and noninvasive means for making an early diagnosis of ileocecal Crohn's disease in

patients who present with atypical symptoms. It may prevent both unnecessary therapeutic delay as well as unnecessary surgery.
Keywords: Ultrasound. Crohn's disease. Appendicitis

Introduction:

In our institute, US is used liberally in patients with abdominal symptoms. Virtually all patients with acute, subacute, or chronic abdominal symptoms undergo US at an early phase of their diagnostic work-up.

In classic cases, the clinical diagnosis of ileocecal Crohn's disease is easily made. When a patient presents with a history of abdominal pain, diarrhea, fever, weight loss, a palpable mass in the right lower abdomen, and a history of perianal fistula, the doctor will usually suspect Crohn's disease. Subsequently, barium studies and endoscopy with biopsy will confirm the disease. At times, however, the diagnosis can be very difficult to make. In patients who have long-standing and atypical symptoms there may be a diagnostic delay of months to even years [1].

On the other hand, there are also patients with ileocecal Crohn's disease in whom the initial symptoms present so acutely, mimicking those of acute appendicitis, that they lead to an unnecessary laparotomy.

Small-bowel enteroclysis is the traditional imaging modality of choice for diagnosis of ileocecal Crohn's disease. However, enteroclysis is usually performed only when the physician already suspects Crohn's disease. Liberal use of enteroclysis in patients with atypical or acute abdominal symptoms is not common practice, understandable in view of its discomfort and radiation in a relatively young age group.

Colonoscopy with cannulation of the terminal ileum can provide a definitive diagnosis of ileocecal Crohn's disease. However, liberal use of colonoscopy in young patients with acute or atypical abdominal symptoms is also not common practice: colonoscopy is an invasive procedure, and will not reach the ileum in all cases [1].

Ultrasound (US) is an attractive alternative for the examination of patients with atypical abdominal symptoms, either acute or chronic. Due to its noninvasiveness, low cost, and ready availability, it is often used as an initial screening modality in patients with abdominal symptoms. Ultrasound can suggest ileocecal Crohn's disease quite reliably [2,3,4,5,6,7,8]. The sonographic hallmark is ileal wall thickening involving all layers of the affected bowel. Next to the terminal ileum, not infrequently, the cecum and appendix are involved. The layer architecture of the bowel wall is often locally disturbed. The affected bowel shows decreased peristalsis, may show a narrowed lumen, and is often surrounded by non compressible fatty tissue. The mesenteric lymph nodes are markedly enlarged, and in many cases there is evidence of an abscess, fistula formation, or prestenotic dilatation [7, 9, 10].

Aim of the study

Given these considerations, we performed a retrospective study to assess the value of US in the early detection of ileocecal Crohn's disease.

Patients and methods:

We collected data on all patients with proven ileocecal Crohn's disease, in whom the primary diagnosis was made over the period from 2000-2006. To identify these patients, we carried out a retrospective search of the databases in the department of gastroenterology, where data of all patients with proven Crohn's disease are collected. We did not exclude those patients in whom the diagnosis of Crohn's disease was made

at another hospital prior to referral to our hospital. We excluded patients with left-sided Crohn's colitis, even if there was also involvement of the ileocecal region. This was done because patients with left-sided colitis usually present with overt colitis-like symptoms, leading to prompt colonoscopy and biopsy.

There were a total of 47 patients. No patient underwent colonoscopy prior to radiological imaging studies. US was the first imaging study performed on all 47 patients. There were 20 male and 27 female. The mean age was 30 years and the median age was 27 years (range 17-70 years). The final diagnosis of ileocecal Crohn's disease was histologically confirmed in 38 cases ; in 17, based on surgical findings and in 21 by endoscpic biopsy. In 38 cases US follow-up, and in all 47 clinical follow-up was available. We retrospectively studied the clinical charts, radiological images, and reports of all 47 patients. We noted the initially presumed clinical diagnosis from the clinical information on the request form, or the accompanying letter by the referring doctor, or from other clinical information available prior to the US examination. We recorded who referred the patient for the initial US examination and who performed this examination.

In our study ,we choose the US examination that was performed by senior radiologists . In all patients the entire abdomen was examined, including the bowel structures. US is performed with graded compression [11]. After examination of the upper abdominal organs, the peritoneal cavity is screened for bowel disease with five to six vertically oriented, overlapping lanes using a broad-based, high-frequency probe (Fig. 1). We refer to this as "mowing the lawn". The US equipment and probes used during the study period were the Aloka SSD-280 LS (5-and 7.5-MHz linear array probes) , the Siemens Elegra & versa pro. (5- MHz curved array and 7.5-MHz linear array probes). The US images are stored on hard copy and the reports are stored digitally.

The US diagnosis was determined from the original, initial US report and divided into **three categories:**

1. Confident US diagnosis of ileocecal Crohn's disease
2. Possible US diagnosis of ileocecal Crohn's disease (mentioned specifically in the differential diagnosis)
3. Incorrect US diagnosis.

From the available US images and reports, the following US features were registered: thickening of the wall of the terminal ileum, disturbance of wall layers structure, thickening of the cecum, appendiceal enlargement (diameter >6 mm), enlargement of mesenteric lymph nodes (short axis diameter >6 mm, [12]), prestenotic dilatetion of small-bowel loops (diameter of >25 mm), presence of inflammatory changes in the surrounding fat, abscess formation, and fistulization. Concerning ileal wall thickening, an anteroposterior diameter of the ileum during compression between the abdominal wall and iliopsoas muscle of more than 6 mm was considered to be abnormal [12]. In this way, the diameters of the ventral and dorsal wall were added up, implying that an ileal wall thickness during compression of more than 3 mm was considered abnormal [11].

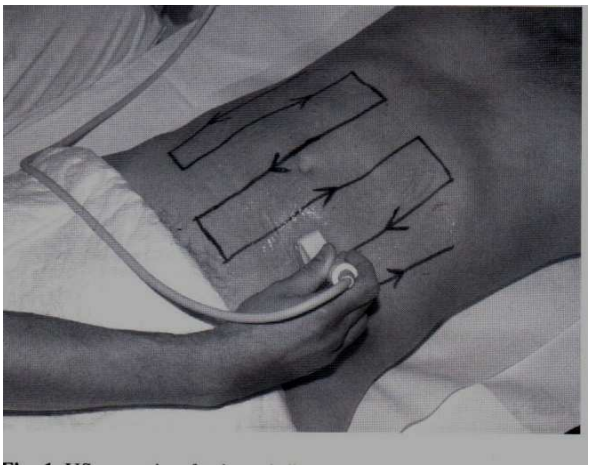

Fig.1: US screening for bowel disease. In every patient undergoing abdominal US, the peritoneal cavity is screened for bowel disease by making vertical, overlapping lanes over the abdomen (mowing the lawn).

Results

Clinical diagnosis

In 19 of 47 patients the referring physician, when requesting the initial US examination, specifically considered "Crohn's disease" or "inflammatory bowel disease," either as the first clinical diagnosis or in the differential diagnosis.

In 28 of 47 patients, the referring physician, when requesting the initial US examination, did not consider Crohn's disease in the differential diagnosis.

Of the latter 28 patients, the family doctor requested the US examination in 11, the attending physician of the emergency ward in 10, while for 7 patients the US examination was requested via the outpatient's department. The presumptive clinical diagnosis was acute appendicitis in nine patients, appendiceal mass in six, functional bowel disorder in six, biliary colic in three, and small-bowel obstruction, ovarian pathology, urinary tract infection, and diverticulitis in one case each (see Table 1).

US diagnosis

A confident US diagnosis of ileocecal Crohn's disease was made in 35 patients, Crohn's disease was suggested in 10, and an incorrect diagnosis of appendicitis and appendiceal mass was made in 2 patients, respectively (see Table 2).

US features

The US features found at the initial US examination in our study group are given in table 3. All 47 patients had an abnormally thickened ileum (Fig.2). During compression, the mean anteroposterior diameter between the-abdominal wall and the iliopsoas muscle was 15 mm (range 9-26 mm; Fig. 3). Hypoechoic changes in the submucosal layer were found in 32 patients. Noncompressible, hyperechoic fatty tissue surrounding the affected ileum was found in 35. Abscesses and fistulization were found in seven patients. Prestenotic dilatation was seen in five patients, involvement of the cecum and/or ascending colon in nine patients, appendiceal enlargement (diameter >6 mm) in four patients, and enlarged mesenteric lymph nodes (shortest axis >6 mm) in 21 patients.

Fig.2: crohn's ileitis. The terminal ieum in axial section, echolucent changes of the normally hyperechoic submucosa &non compressible hyperechoic mesenteric fat (both indicating transmural inflammation).

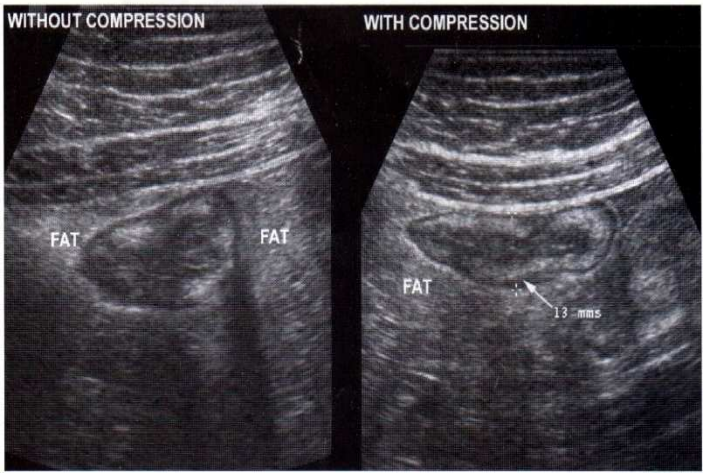

Fig.3: crohn's ileitis.left:terminal ileum axial plane: echolucent changes of the submucosa &surrounding hyperechoic fat.Right:during compression:the ileum & mesenteric fat are moderately compressible. The combi- ned US findings are suggestive of crohn's disease.

Table 1: clinical diagnosis prior to US

Clinical diagnosis	No. of patients
Crohn's disease	19
Acute qppendicitis	9
Appendiceal mass	6
Functional bowel disorder	6
Biliary colic	3
Small bowel obstruction	1
Ovarian pathology	1
Urinary tract infection	1
Diverticulitis	1
Total	**47**

Table 2: US diagnosis

US diagnosis	no. of patients
Confident diagnosis of crohn's disease	35
Possible diagnosis of crohn's disease	10
Acute appendicitis	1
Appendeceal phlegmon	1
Total	**47**

Table 3:US features

US	No. of patients
Ileal wall thickening	47
Hypochogenic submucosa	32
Non compressible surrounding fat	35
Abscess	7
Entero-enteric fistula	7
Entero-vesical fistula	1
Prestenotic dilatation	5
Cecal \ascending colon involvement	9
Appendiceal enlargement (diameter >6mm)	4
Mesenteric lymphadenopathy	21

Discussion

The clinical diagnosis of ileocecal Crohn's disease can be very difficult to make. Many patients have such atypical symptoms that the diagnosis is not considered, resulting in remarkable diagnostic delay [1]. On the other hand, symptoms may be so acute, mimicking appendicitis, that the patients are subjected to an unnecessary operation. Traditionally, the cornerstone of diagnosis has been colonoscopy with biopsy and enteroclysis. However, both studies are usually only requested if the referring physician already considers Crohn's disease on clinical grounds. Colonoscopy and enteroclysis are generally not performed on patients with atypical abdominal symptoms or patients with acute abdominal symptoms.

CT can demonstrate Crohn's disease and the CT features are well established [13, 14]. CT is generally not performed as an initial screening procedure in patients with atypical and protracted abdominal symptoms [15]. CT is, however, increasingly used as a screening procedure in patients with acute abdominal symptoms [16] and will undoubtedly also help detect many clinically unsuspected cases of Crohn's disease.

US is increasingly used as the initial screening modality in patients with abdominal symptoms [17]. The US features of Crohn's disease were described as early as 1979 and confirmed by many authors [2,3,4,5,6,7,8,9,10, 18, 19].

With modern US equipment it is possible to make a confident US diagnosis of Crohn's disease in the majority of cases [7]. Prospective studies found a sensitivity of more than 90% for US[4, 20], but included only patients with known or clinically suspected Crohn's disease. Our study found a comparable high sensitivity of 96% in patients in whom the diagnosis of Crohn's disease was not known, and in the majority

(28 of 47 patients) was not even suspected. In eight patients with appendicitis-like symptoms, an unnecessary appendectomy was probably avoided because of the US findings.

In ten patients in our study, the thickened ileum was clearly demonstrated with US, narrowing down the differential diagnosis and giving direction to subsequent diagnostic examinations. Ileocecal Crohn's disease, however, was not mentioned as the first diagnosis in seven of these ten patients, because there was only thickening of the mucosa and submucosa of the ileum and cecum and there was no inflamed fat around the bowel: these findings indicated that there was no transmural progression of the inflammation at that time. Therefore, in these seven patients the first diagnosis was infectious ileocecitis caused by Campylobacter, Salmonella, or Yersinia; however, Crohn's disease was listed in the differential diagnosis of all seven patients [21]. Since the initial clinical management in both Crohn's disease and infectious ileocecitis is nonsurgical, this error only led to a minor delay in medical treatment. As stool cultures remained negative, symptoms persisted or increased, and the US images progressed to show transmural inflammation, the diagnosis of Crohn's disease became apparent within 4 weeks in all seven cases. In the remaining three cases, the primary diagnoses were tuberculous ileitis, small-bowel obstruction due to adhesions, and appendiceal mass. In all three cases, however, Crohn's disease was mentioned as a possibility and accordingly the initial management was nonsurgical. Following subsequent US examinations, the diagnosis was corrected to Crohn's disease within 1-3 weeks.

Of the two patients in our study in whom the US findings were abnormal but were misinterpreted, in one the thickened ileum was mistaken for an inflamed appendix, leading to an unnecessary laparotomy. In the other patient, the presumptive diagnosis was an appendiceal mass: this did not affect patient management since both this condition and Crohn's disease are initially treated nonsurgically. The correct diagnosis of ileocecal Crohn's disease was suggested 1 week later following a second US examination.

An important limitation of our study is that it provides no data on possible false-positive diagnoses. Because of its retrospective character, including only patients with proven Crohn's disease, it is impossible to assess the specificity of US in diagnosing ileocecal Crohn's disease in our study.

The retrospective character of our study has also some advantages, mainly due to it being a more accurate reflection of daily practice, rather than the situation of high alertness that the prospective study imposes.

The frequent use of US in patients with atypical abdominal symptoms may be considered expensive; however, there is also benefit in avoiding unnecessary operations and resulting in earlier correct medical treatment. Moreover, ileocecal Crohn's disease is only one of many diseases that benefit from early diagnosis by US. In fact, management of most acute abdominal conditions benefits greatly from the liberal use of US [11].

The reasons for the high "pick-up rate" of US for ileocecal Crohn's disease may be the way US is performed in our study. All US examinations are performed by senior radiologist, additionally, in every patient, next to the area of interest, the entire abdomen is examined including the bowel structures using the "mowing the lawn" technique as described in the methods section. Another fortunate circumstance facilitating detection of Crohn's disease is that this illness is more often found in slim patients and the inflamed ileum is fairly conspicuous on US. The thickened small bowel is markedly hypoechoic while the surrounding fatty tissue is hyperechoic.

Conclusion:

The liberal use of US in patients with abdominal symptoms constitutes a powerful and reliable tool for the early detection of ileocecal Crohn's disease. It may decrease diagnostic delay as well as prevent some unnecessary operations.

Recommendation:

We recommend more specified widebroaded prospective studies of the suspected inflammatory ileocecal diseases , that to detect the specificity of ultrasound in crohns disease , to prevent both delayed management & unnecessary operations.

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