Is it possible to limit the use of CT scanning in acute diverticular disease without compromising outcomes?

A preliminary experience

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It is possible to limit the use of CT scanning in a cute diverticular disease without compromising outcome? A preliminary experience

The aim of our study was to determine whether the use of CT scanning in the assessment of acute diverticulitis can be reduced without a negative effect on outcome.
Our series consisted of 93 out of 100 patients with acute diverticulitis admitted to the Emergency Room of our institution in the period from February 2012 to March 2013.The Hinchey classification system was used to stage disease based on findings on ultrasound (US) examination and/or computed tomography (CT) scanning. We compared the patients' Hinchey stage (HS) on admission and 72 hours later. Types of treatment were defined as emergency or delayed intervention (operative approaches (OA); ultrasound-guided percutaneous drainage (UPD), and surgery. The borderline between conservative and surgical management was identified. In patients with a HS </= 1b surgical intervention was never required and therefore we believe that US imaging is sufficient and they can be spared the exposure to ionizing radiation associated with CT scans. The skill of the individual operator in US examination was found to be of key importance. As regards CT scanning, we found, in agreement with the literature, that it has greater specificity and sensitivity than US, and is therefore indicated if the patient's condition has deteriorated.

KEY WORDS: Acute diverticulitis, CT scan, Ultrasound scan

Introduction

Given the modern guidelines on limiting healthcare costs and stochastic risks, the aim of our study was to determine whether it was possible to limit the use of computed tomography (CT) scanning in acute diverticulitis and instead increase the use of ultrasound (US) [1]. We took account of the lower specificity of US [2], especially in studies of the intestinal loops in acute disease. However we also kept in mind that US is very practical and easy to use and thus well-suited for bedside diagnosis of the patient in the Emergency Room (ER). We determined in what setting the use of US [2] as a diagnostic modality can be considered to have no contraindications [3].

Materials and Methods

We conducted a retrospective study on 100 patients admitted to the ER for acute diverticulitis in the period from February 2012 to March 2013, (median age 46 years, range 24-92 years), to determine whether CT findings 72 hours after admission were important for planning treatment. Data was gathered from patient charts.

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Seven patients were excluded from the study because their Hinchey stage (HS) had not been determined on admission. Twelve patients underwent operative approaches (OA). A total of 14 OA were performed because in 2 of the patients the percutaneous procedure was not effective and both then underwent surgery. All e 93 patients (Fig. 1) arrived from the ER with a diagnosis of acute diverticulitis (assessment 1:A1) based on 85 US exams and 29 CT scans, selected by the admitting physician. Fifty-five of the patients had fever, with a mean temperature of 37.6°c (range: 37.1°-39.2° C) and 48 hours after admission only 26 still had fever (mean temperature: 37.4° C, range: 37.1°-39.8°C). Nine of these 26 patients (75%) were from the OA group.
Eighty-four of the patients with a HS on admission (90.3%), underwent a second assessment,72 hours after admission (assessment 2:A2) since there was no evidence of early and significant clinical improvement [3], by means of 26 US studies and 79 CT scans selected based on the quality of the imaging studies performed in A1. Twenty-one of them were re-evaluated using both imaging modalities. Five had to undergo US because their serum creatinine was > 3 mg/dl, 2 because they were allergic to contrast agent, and a CT scan was not an option in one because of the patient's claustrophobia.
A comparison of HS on admission (A1) and at A2 showed a change in HS in 38 patients (40.8%) out of the 93 with a HS. Thirty of them (78.9%) were in a higher stage at A2, whereas 8 (21.1%) were in a lower stage. Fifty-five patients (59.1%) had the same score in A1 and A2. There was no change in stage for any patient in stages 3-4 (n=6). Four (10.5 %) of the patients whose HS changed underwent OA.
Six OA patients (50%) underwent CT scanning in A1, but only 3 had a repeat CT scan in A2 while the other 3 underwent US imaging. Two patients (16.6%) had a CT scan only in A2. In one of the latter 2, although the CT scan revealed a lower HS on A2, ultrasound-guided percutaneous drainage (UPD) was performed because the abscess could easily be reached percutaneously (Fig. 1).The remaining 4 underwent emergency laparotomy, because abdominal x-ray showed free air in the abdomen All OA patients had positive peritoneal signs on physical examination (Fig. 3). No patients in Hinchey stage Ho-H1b underwent OA even if they had positive peritoneal signs, whereas 2 of the 3 patients in 2a (66.6%), and both of the patients in H2b (100%) did.
The types of OA performed were: UPD (n=7), Hartmann's procedure with diverting colostomy (n=5), this included the 4 emergency cases and surgical toilet and drainage (n=2) in 2 patients in whom UPD had failed.
Cultures of the fluid aspirated in UPD or the lavage fluid or fluid directly taken from an intra abdominal abscess, revealed bacteria, predominantly Escheria Coli and Enerococcus Avium, and fungi; Candida Albicans. Nine (75%) of the 12 OA patients were put on antibiotic therapy with ceftriaxone (2g/day) and metronidazole

	T1				T2			
Number assigned to the patient	HS	US	CT	OA type	HS	US	CT	OA type
8	2a	0	1	Hartmann				
27	4	1	0	Hartmann				
47	4	0	1	Hartmann				
52	4	1	1	Laparoscopy drainage				
85	4	0	1	Hartmann				
5	2a				2b	1	1	US guided drainage
11	2b				2b	1	0	US guided drainage
26	2a				3	1	1	Hartmann
32	2a				2a	0	1	US guided drainage
38	2b				3	1	1	Hartmann
61	2b				2b	1	1	US guided drainage
91	2b				2a	1	1	Laparoscopy drainage

Fig. 1: Analysis of the diagnostic procedure used for patients assigned to OA in A1 and A2.

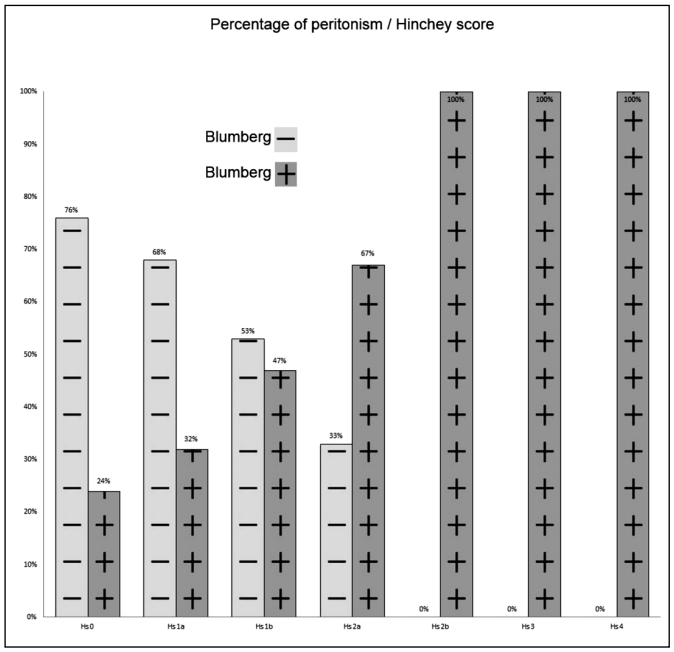

Fig. 2: Clinically objective peritoneal sensitivity.

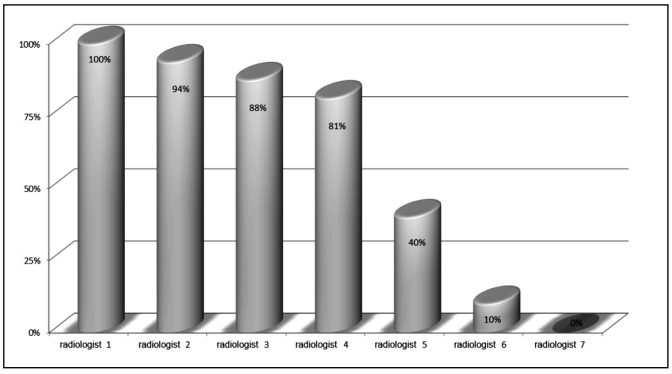

Fig. 3: Level of consistency between US and CT scans per radiologist.

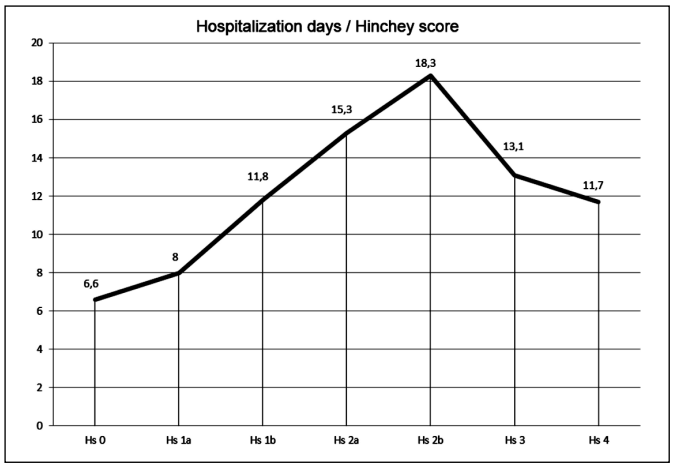

Fig. 4: Average hospitalization.

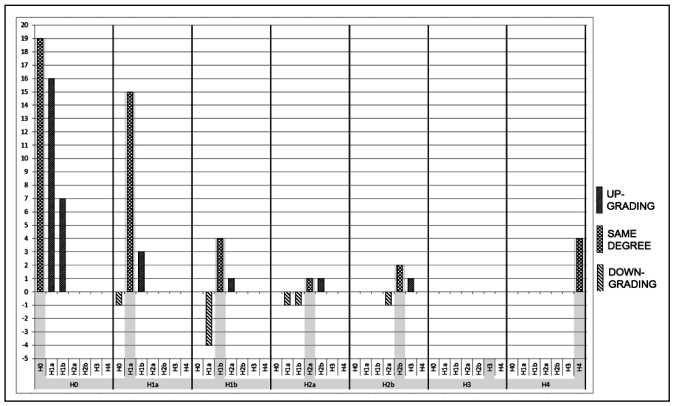

Fig. 5: Shift of Hinchey class in A2.

(1500mg/day) with fluconazole (400 mg/day) added in the 3 cases(25%) of fungal infection, 2 patients (16.6%) were given piperacillin tazobactam (13.5 mg/day), and one patient (8.3%)was given amoxicillin (12mg/day). All patients were also put on mesalazine (2400mg/day).
When the US and CT reports for one patient described substantially the same findings, the examinations were described as being in agreement. When reports were compared to determine the degree of agreement between US in A1 and CT in A2, there were 27 cases (32%) of non-agreement and 2 (2.1%) cases in which the US technique was not thought to be suited to the somatic characteristics of the patient (obesity). The agreement rate between the first and second assessments is shown in Fig. 4. There was a group of 4 out of 7 radiologists, with an average 90.6% agreement rate, while the other 3 had only an average agreement rate of 13.3%.
Average length of hospital stay was 9.32 days (range 2-32 days), with a 18.3-day high for patients in H2b (Fig. 6). H2b patients had the longest hospital stay because H3 and H4 patients underwent immediate or deferred, but still early, OA.

Results

We observed that in patients with acute diverticulitis preliminary assessment using the HS is of fundamental importance. In patients in HS H0- H1b there were no changes in stage in A2 significant enough to necessitate changes in management. Therefore, as regards patients in these HS, there was no benefit in the use of CT scanning, especially in A2, to determine what treatment to adopt, unless the patient's clinical condition had deteriorated. The 12 patients who underwent OA all had fever and localized peritoneal signs. However, the latter, when found in patients in stages H0-H1b, were not a prognostic marker indicating for the need for OA. The literature has illustrated that CT scanning is a more reliable diagnostic modality than US [2], especially in the identification of free air in the abdomen, deep abscesses, and in obese patients. Our study confirms the importance of the skill of the operator (Fig. 4) for the reliability of US findings. US remains the most manageable imaging modality and the most suitable for bedside diagnosis, and especially for use in the ER. The clinical course of patients in HS H2-H4 was less predictable than that of patients in H0-H1b.
A line graph of the average length of hospital stay (Fig. 6) shows that the average length of stay was directly proportional to Hinchey stage, with a steep decline in the curve for patients in stages H3 and H4, since OA significantly reduced the average recovery time. Average length of stay for OA patients was 11.75 days .

Discussion

A2, 72 hours after admission, was required in 84 cases in our series of patients with acute diverticulitis, based on the complex clinical picture of the patients, to evaluate indications for changes in treatment. It was shown that there had been a change of HS in 38 patients, predominantly a change from H0 to H1a/H1b (n=16 and n=7 respectively). Overall 8 patients had a lower HS in A2 than in A1. Five of them went from H1b to H1a. It should be noted that stages H3 and H4 can be considered "stable" based on our experience: all H3 and H4 patients underwent OA, though the timeframes varied. For H3 patients the time until OA was longer since they first underwent medical treatment followed by UPD. As regards patients whose Hinchey stage increased, and especially those patients who underwent OA, we found 5 in A1 and 7 in A2. Four of the former were H4 and therefore emergency surgery was indicated. Of the 7 patients (10.5%) who underwent OA after CT-scanning in A2, only 2 had a higher Hinchey stage in A2 than in A1 and both initially had H2 disease with limited inflammation. but there was no evidence that surgery was required. Six of the patients found to have a higher Hinchey stage in A2, the operator had chosen to use

US plus CT scanning. This supports the view that the latter diagnostic tool is indispensable [1-3].

Out of the 38 patients whose Hinchey stage in A2 was not the same as in A1, 7 (10.5%), all of them >H1b, were candidates for OA. In one case the patient's clinical condition worsened slightly despite a shift from H2b to H2a, and since the intraabdominal abscess could be easily reached, UPD was performed.

Our study shows that in A2 a CT scan is only needed for patients in stage H2 and up or those in stage H1b and lower whose clinical picture and biochemical parameters are deteriorating. We observed a relationship between HS and the frequency of peritoneal signs (Fig. 2).Usually there was diffuse peritoneal irritation in stages H2b-H4 whereas it was mild and more localized in stages H0 and H1a. Stages H1b-H2a were therefore at the borderline between conservative management and OA [5] (Fig. 3). None of the patients in lower stages required invasive treatment even if they had localized peritoneal signs. It is therefore reasonable to conclude that CT scanning in A2 is useless in patients who were classified as H0, H1a ,or H1b on admission, unless their clinical condition deteriorates [6]. One should keep in mind that in 55 patients (65.4%) the findings on the initial US examination corresponded with the CT scan results in A2, while in 27 (32.1%) the diagnosis was substantially modified in A2. In 2 cases (2.3%) US could not be used because of patient-related problems. The striking difference in reliability between the various operators (90% in operators 1-4 vs, 16.6% in operators 5-7), shows the importance of individual skill in this diagnostic modality. US is especially difficult to perform in patients with acute diverticulitis who often have intestinal paresis, distended intenstinal loops and whose abdomen is tender. We recommend:1) CT scanning in the ER, at least in cases where the results of US examination are not satisfactory and not entirely compatible with the clinical findings, 2) use of US in A2 in cases of uncomplicated diverticulitis with Hinchey stage <H2a). Greater care should be taken in the future to limit requests for CT scans in patients with diverticulitis, especially those in Hinchey stages H0-H1b, in order to spare patients unnecessary exposure to ionizing radiation and to reduce costs [8-10] .

Conclusions Our results confirm the importance of diagnostic imaging on admission in cases where diverticulitis is suspected. In addition, the Hinchey classification system is important for determining optimal management. The presence of peritoneal signs, even if localized, is a warning sign, having been found in all our patients who underwent OA. Moreover, all of them had a Hinchey stage >H1b which suggests that special attention should be paid to all patients in Hinchey stages > H1b. Patients who were H0, H1a, or H1b, even if localized, but not worsening peritoneal signs were observed, were treated only with antibiotics, intravenous fluids and topical anti-inflammatory drugs. Our results also show, in agreement with the literature, that CT scanning has a greater sensitivity and sensibility than US and therefore it is important that CT scanning be an option in A2 in cases that are, or are suspected to be, deteriorating. US is not specific for this type of disease. In fact, in our study there was a major difference in US results depending on the skill of the individual operator. Nevertheless, both US and CT scanning should be available considering the limitations of each modality. US is not useful in cases of severe meteorism and obesity and CT scanning with contrast should be avoided in patients with renal insufficiency, allergy to contrast material, and those with psychological problems related to the examination (anxiety,claustrophobia). Since a patient should be exposed to ionizing radiation as little as possible, CT scanning is only justified if there is worsening of the patient's clinical condition without a clear indication for invasive intervention, insufficient reliability of radiological findings in A1, or in A2, in patient's classified as >H1b. Seeing that the present study did not provide any evidence that significant changes in treatment were necessary for patients in stages<H2a, it is our opinion that routine CT scanning is not necessary in these patients.

Riassunto

Da una casistica personale di 100 pazienti, giunti all'osservazione presso il Dipartimento di Emergenza per sindrome diverticolitica acuta, abbiamo considerato il punteggio Hinchey (Hs) attribuito a 93 di questi all'ingresso sulla base di indagini randomizzate a mezzo di Ultrasuoni (US) e/o con Ctscan; abbiamo rivalutato il punteggio al secondo controllo a 72 ore. Abbiamo considerato le classi trattate con procedura interventistica d'urgenza o differita (Operative Approaches :OA) con puntura percutanea ecoguidata (Ultrasound Percutaeous Drainage: UPD) o trattamento chirurgico. Abbiamo individuato l'area di confine tra la necessità di intervento e la terapia conservativa. Nel gruppo di pazienti con Hs =/<1b, non è mai stato necessario intervenire. Su queste classi di pazienti, reputiamo essere giustificato il controllo ultrasonografico con risparmio della somministrazione di radiazioni ionizzanti. Abbiamo rilevato l'importanza della abilità individuale del radiologo per la lettura ecografica dei dati della parete viscerale pur riconoscendo, in accordo con la letteratura, la maggior specificità dell'esame tomografico computerizzato rispetto agli US.

References

1. Puylaert JB: *Ultrasound of colon diverticulitis*. Dig. Dis, 2012: 30(1):56-9.

2. Humes DJ: *Diagnosis and managing acute diverticulitis.* Practitioner, 2012; 256(1753):21-3.

3. Cartabellotta A: *Overdiagnosis: La faccia oscura del progresso tecnologico*? Evidence, 2012; 4(2):e 1000008.

4. Anderson JC, Bundgaard L, Elbrond H, Laurberg S, Walker LR, Storving J: *Danish national guidelines for treatment of diverticular disease*. Dan Med J, 2012; 59(5):C4453.

5. Zinzindohouè F, Samama G: *Colonic diverticulosis: which patients need surgery?* Rev Prat, 2009; 59(1):19-9.

6. Tonelli F, Di Carlo V, Liscia G, Serventi A: *Diverticular disease of colon: Diagnosis and treatment. Consensus Conference, 5th Natrional Congress of the Italian Society of Academic Surgeons*. Ann Ital Chir, 2009; 80(2):3.

7. Vasilleva MA: *Ultrasound study in colonic diverticular microperforation*. Vestn Rentgenol Radiol, 2011;(5):24-7.

8. D.Lgs 187/700*: Attuazione direttiva 97/43 EURATOM in materia di protezione sanitaria delle persone contro i pericoli delle radiazioni ionizzanti connesse a esposizioni mediche.*

9. ICPR 34/82: La protezione del paziente in Radiologia Diagnostica

10. Attuazione della direttiva 8096/29/EURATOM in materia di protezione sanitaria della popolazione e dei lavoratori contri i rischi derivanti dalle radiazioni ionizzanti. Decreto legislativo 26 maggio 2000, n 241- supplemento ordinario della Gazzetta Ufficale n.203 del 31 agosto 2000.