CT and ⁹⁹mTc-WBC vs colonoscopy in the evaluation of inflammation and complications of inflammatory bowel diseases

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Introduction

The exact role of computerized tomography (CT) in the investigation of IBD is controversial. CT is recommended by some¹ as an important tool in the evaluation of patients with suspected colonic inflammation. CT is also believed to be important in the diagnosis and management of inflammatory bowel diseases (IBD) in patients presenting with acute symptoms,² as a management tool in the evaluation of patients with known IBD,³ presenting with exacerbation of their disease,²,⁴ and as an essential diagnostic tool in the acutely ill patient with Crohn’s disease (CD).⁴,⁵ Finally, CT has been recommended as an initial imaging study in children with known CD and a changing pattern of clinical symptoms.³

For others,⁴ the role of CT is limited to the assessment of mural disease and its effect on luminal diameter, and the differential diagnosis of mesenteric disease. Still others have noted that there is a disturbing lack of correlation between radiographic findings and the clinical severity and activity of the disease.⁴,⁷ For some, CT was not useful for detecting early CD.⁵,⁸ Failure to adequately opacify the bowel wall may lead to scans that are difficult to interpret, or to the overestimation of bowel wall thickening.⁵ Abnormal bowel thickness can also be seen in cirrhosis, lymphoma, infection, diverticulitis, pancreatitis, edema, hypoalbuminemia, ischemia, Henoch-Schönlein purpura, and bleeding in the bowel wall.⁸,¹⁰ In one recent report, abnormal wall thickness was seen in 7% of controls.¹⁰ The presence of mesenteric masses is not a helpful sign for differentiating various disease processes.⁹ In one series, 83% of children with bowel thickness greater than 1 cm had neoplastic disease.⁹ Tomei et al.¹¹ evaluated the correlation of CT findings with laboratory indices of inflammation in patients with CD. All patients had abnormal CT findings. One-fourth of the patients with abnormal bowel wall thickness had normal laboratory values, indicating that

Background. The goal of this study was to evaluate the accuracy of computerized tomography (CT) and ⁹⁹mTc-white blood cell (WBC) scintigraphy versus colonoscopy in assessing inflammatory bowel diseases (IBD) in a large population of children. Methods. In a patient population of 313 consecutive children who had a ⁹⁹mTc-WBC scan, 106 colonoscopies were done within a median time interval of 8 days of the ⁹⁹mTc-WBC scan. One hundred and three CT scans were performed on 84 patients. Results. Of the 42 CT scans obtained within a short time interval after the ⁹⁹mTc-WBC scan, 21 (50%) were normal. In the 21 children with a positive ⁹⁹mTc-WBC scan, 62% (13/21) of the CT scans underestimated the bowel wall inflammation in at least one segment. In the children with a negative ⁹⁹mTc-WBC study, there were 17 negative CT examinations and 4 examinations showing an abnormal terminal ileum. When CT was compared with colonoscopy in assessing inflammation, there were five true-negative CT, two true-positive CT, no false-positive, and seven false-negative CT examinations. When ⁹⁹mTc-WBC scintigraphy was compared with colonoscopy in assessing inflammation, there were seven true-positive, two false-negative, five true-negative, and no false-positive ⁹⁹mTc-WBC studies. The ⁹⁹mTc-WBC scan was positive in five patients with a false-negative CT examination. Of the total 103 CT scans obtained, 53 (51%) were normal. Four abscesses (3.8%) were demonstrated by CT. Conclusions. ⁹⁹mTc-WBC scintigraphy is more sensitive than CT for detecting inflammation of the bowel wall. The incidence of complications from IBD in this retrospective study was much lower than had been previously reported.

Key words: inflammatory bowel disease, Crohn’s disease, computerized tomography, ⁹⁹mTc-WBC

Received: February 26, 2001 / Accepted: June 6, 2001
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the disease findings were quiescent, and yet the CT findings were abnormal. An abnormal layer of submu-
cosal attenuation was seen in all patients, all without
evidence of active disease. Others have also reported
that patients with quiescent disease may have abnormal
wall thickening on CT. A prominent submucosal layer
of decreased attenuation on CT is not specific, and can
be caused by fat deposition or active inflammation.
Additionally, CT cannot differentiate thickening caused
by edema and cellular infiltration from that caused by
fibrosis. Gossios et al. demonstrated that bowel wall
thickening, the most common pretreatment abnormal-
ity, may remain abnormal for many years after treat-
ment. The presence of a “target” or halo sign is not
specific for IBD.

The goal of this study was to compare, in a large
population of children with suspected or known IBD,
the accuracy of CT and 99mTc-white blood cell (WBC)
scintigraphy versus colonoscopy in assessing bowel in-
flammation. A second objective of this study was to
evaluate the incidence of complications detected by
each modality.

Patients and methods

Patients

Over a 6-year period, 313 consecutive 99mTc-WBC stud-
ies were performed, and the hospital charts of these
children were reviewed (Table 1). There were 144 boys
and 169 girls (average age, 13 years). Three groups of
children were evaluated: (a) 132 children with known
IBD who had a 99mTc-WBC scan for assessment of a
clinical flare; (b) 130 children who had a 99mTc-WBC
scan to exclude IBD; the final diagnoses (based on
colonoscopy and biopsies) in this latter group were CD
in 27, ulcerative colitis (UC) in 9, miscellaneous colitis
(MC) in 13 (7 indeterminate colitis [IC], 4 infectious
colitis, and 2 autoimmune colitis), normal in 39 (normal
colonoscopy), and probably normal (PN) in 42 (children
with no evidence of IBD by clinical follow-up and radi-
ographic study and no colonoscopy); and (c) the third
group, who consisted of 51 controls (NL) who had un-
dergone 99mTc-WBC scanning for other medical prob-
lems (final diagnoses: osteomyelitis, cellulitis, trauma,
myocarditis, fever of unknown origin, painful hip, and
peritonitis).

Colonoscopy

Total colonoscopy, using an Olympus CF100TL or
PCF20 instrument (Olympus Optical, Tokyo, Japan)
was performed to assess the extent and activity of the
mucosal inflammatory changes in eight intestinal
segments, defined below. The endoscopic findings
of inflammatory activity were classified as absent
(noninflamed mucosa), mild (granularity, edema, invis-
ible vascular pattern), moderate (hyperemia, friability,
and all features of mild activity), or severe (ulceration,
in addition to features of moderate activity).

One hundred and six colonoscopies were done,
within an average time interval of 14 days (median, 8
days) of the 99mTc-WBC scan. One hundred and three
CT scans were performed on 84 patients. Forty-two CT
scans were done within an average time interval of 8
days of the 99mTc-WBC scan. Fourteen patients had the
three examinations (CT, 99mTc-WBC, and colonoscopy)
performed at mean time intervals of 11 days, and three
additional patients had colonoscopy and CT performed
within a short time interval.

In children with no recent colonoscopy, the findings
of the 99mTc-WBC scan were compared with findings on
long-term clinical follow-up, laboratory values, and with
the gastroenterologist’s initial clinical assessment. The
average elapsed time between 99mTc-WBC scintgraphy
and the clinical follow-up was 285 days.

Performance of the scans

Labeling of leukocytes with Tc99m has been described. At 0.5–1 h after injection, imaging was done with a large field of view (LFOV) gamma camera fitted with a low-energy, all-purpose collimator (SMV, Twinsburg, OH, USA). Anterior and posterior 8-min images of the ab-
domen and pelvis were recorded in analog and digital
form. Pelvic outlet views were also obtained to distin-
guish bladder activity from rectal activity. Anterior
views of the abdomen, with the patient standing, were
obtained to separate the liver from the transverse colon.
Two to four hours after injection, an 8-min anterior
view of the abdomen was repeated. Single photon emis-

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<tr>
<th>Table 1. Patient data</th>
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<td>Number of children</td>
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<tr>
<td>Male</td>
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<tr>
<td>Female</td>
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<td>Average age (years)</td>
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<td>Indeterminate colitis</td>
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IBD, Inflammatory bowel diseases; CT, computerized tomography;
WBC, white blood cell