Stephanie P. Ryan · Godfrey Gaisie · Richard A. Kraus

CT scanning of children with blunt abdominal trauma – is oral contrast useful?

Abstract  Purpose: To determine the usefulness of oral contrast in CT scanning of children with blunt abdominal trauma by comparing scans performed with and without oral contrast. Methods: CT scans of 273 children with abdominal trauma and 40 without trauma were reviewed. Results: Of the trauma patients, 116 (43%) were scanned with oral contrast, 157 (57%) without. Among the children who underwent laparotomy, CT scanning identified 6 of 6 organ injuries in those scanned with oral contrast and 11 of 12 in those scanned without. CT scanning identified all bowel injuries. The pancreatic body and tail were significantly better visualized in scans with oral contrast. Detection of pancreatic or liver injury was not, however, significantly different in the two groups. Opacification of the bowel by contrast was significantly better in elective than in trauma patients. Conclusion: There was no difference in detection of injuries between children scanned with and without oral contrast.

Key words  Computed tomography – Contrast media – Abdomen – Injuries – Computed tomography in infants and children

Introduction

Computed tomographic (CT) scanning is the optimal method of imaging children with blunt abdominal trauma [1, 2]. The value of oral contrast for CT scanning in abdominal trauma patients has been questioned [3, 4, 5, 6, 7, 8], since its use may be associated with some delay in scanning or a risk of aspiration. Few studies have directly addressed the issue of whether or not the use of oral contrast increases the detection of abdominal injury: most reports on abdominal CT in trauma come either from centers that predominantly use oral contrast [8, 9, 10, 11, 12, 13, 16] or from centers that do not [1, 3, 17, 18]. In our hospital children with abdominal trauma are scanned with or without oral contrast depending on the trauma surgeon who refers them: all patients of one surgeon who favors its use are given oral contrast, while patients of the other two trauma surgeons are never given oral contrast.

We proposed evaluating the usefulness of oral contrast in CT scanning of children with abdominal trauma by comparing scans in a group of children who received oral contrast with those of a group who were not given oral contrast. A comparison was also made between the effectiveness of bowel opacification in trauma and nontrauma scanning.

Materials and methods

Patients and imaging protocol

Clinical records and CT scans of 284 consecutive children who underwent CT scanning of the abdomen for blunt abdominal trauma over a 3-year period were retrospectively reviewed. Clinical and CT data were available for 277 of these patients (97.5%). Four patients were excluded because their scans were considered nondiagnostic because of motion artifact. Thus, 273 children made up the study group.

Patients varied in age from 2 months to 19 years, with a median age of 11 years. Mechanisms of injury included motor vehicle accident (n = 158), fall (n = 36), bicycle injury (n = 20), assault (n = 9) and sledding injury (n = 5).

CT examinations were performed on a GE9800 scanner (GE Medical Systems, Milwaukee, Wis.). Ten-millimeter beam collimation was used with 10-mm table increments from the top of the diaphragm to the iliac crest. After a delay of 5 minutes, sections through the pelvis were obtained. Rapid hand injection of intravenous contrast [iothalamate meglumine (Conray 60%), Mallinck-
Table 1: Comparison of oral contrast and no oral contrast groups. 

<table>
<thead>
<tr>
<th></th>
<th>Oral contrast</th>
<th>No oral contrast</th>
<th>P-value or ns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (years)</td>
<td>10.3 (± 0.44)</td>
<td>10.1 (± 0.38)</td>
<td>P = 0.7, ns</td>
</tr>
<tr>
<td>Number of patients admitted to hospital</td>
<td>82 (70%)</td>
<td>94 (60%)</td>
<td>P = 0.06, ns</td>
</tr>
<tr>
<td>Days in hospital if admitted</td>
<td>6.5 (± 0.7)</td>
<td>7.1 (± 0.7)</td>
<td>P = 0.5, ns</td>
</tr>
<tr>
<td>Laparotomy</td>
<td>5 (4.3%)</td>
<td>8 (5.1%)</td>
<td>P = 0.7, ns</td>
</tr>
</tbody>
</table>

*All values are absolute numbers (with percentage in parentheses) or means (with standard error in parentheses)*

Table 2: Visualization of the pancreas: comparison of scans with and without oral contrast.

<table>
<thead>
<tr>
<th></th>
<th>Oral contrast</th>
<th>No oral contrast</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of scans with pancreas well visualized</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pancreatic head</td>
<td>85 (73%)</td>
<td>104 (67%)</td>
<td>P = 0.38</td>
</tr>
<tr>
<td>Pancreatic body</td>
<td>86 (73%)</td>
<td>88 (57%)</td>
<td>P = 0.01</td>
</tr>
<tr>
<td>Pancreatic tail</td>
<td>83 (71%)</td>
<td>88 (57%)</td>
<td>P = 0.01</td>
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Data collection

Medical and surgical records were reviewed. Data collected included age, mode of injury, presence of associated injuries, whether the patient was hemodynamically stable at the time of CT, whether the patient was admitted to hospital, and the duration of hospital stay. Records were reviewed for any clinical evidence of complications of oral contrast use. Laboratory data recorded included the hemoglobin level, serum amylase and liver enzyme values, and any change in these over the first 24 h. Twelve patients underwent laparotomy. Operative findings in these cases were recorded.

Abdominal CT studies were reviewed by three radiologists blinded to the clinical details and outcome. The effectiveness of bowel opacification in patients who received oral contrast was graded using a three-point scale, from good to poor to no opacification, for each part of the gastrointestinal tract. The degree of visualization of the pancreatic head, body, and tail was also graded. Any injuries, free air, or fluid, and other findings were recorded.

A total of 3780 observations each were made by the three radiologists in CT scan interpretation. A further 42 observations each were made by two radiologists. Of the observations made by three radiologists, all three agreed in 3679 observations (97.3%) and two agreed in 138 (2.6%). There was no agreement in 5 observations (0.1%). These latter observations were excluded from the analysis of the data.

Comparison of bowel opacification in trauma and nontrauma CT scans

Table 2 compared the visualization of the pancreas in scans with and without oral contrast. Oral contrast was given to 116 children (43%), while 157 children (57%) did not receive oral contrast.

Data analysis

For the trauma patients, the data of the group who received oral contrast were compared with those of the group who did not. Bowel opacification in the trauma patients who were given oral contrast was also compared to that in the elective patients. For each comparison, continuous variables in the two groups were compared by Student’s t-test. Categorical variables in the two groups were compared by χ² test or Fisher’s exact test where appropriate. P values less than 0.05 were considered significant. Statistical analysis was performed using JMP software (version 3.1, SAS Institute, Cary, NC).

Results

Patients

Oral contrast was given to 116 children (43%), while 157 children (57%) did not receive oral contrast. The two groups were similar in terms of age, mechanism of injury, number of patients admitted to hospital, length of hospital stay, and the number who underwent laparotomy (Table 1). There was no record of any complication due to use of oral contrast.

Opacification of bowel and visualization of the pancreas

Of those who received oral contrast, satisfactory (fair or good) opacification of the stomach, duodenum, and jejunum was achieved in 90%, 69%, and 68% of patients respectively. Opacification of ileum and colon was achieved only in a minority, 45% and 12% of patients respectively.

There was no significant difference in the number of patients with good visualization of the pancreatic head in those scanned with oral contrast compared with those scanned without. However, visualization of the pancreatic body and the tail was significantly better in the group who received oral contrast than in the group who did not (Fig. 1, Table 2).

rod, St. Louis, Mo.) or iohexol (Omnipaque 240, Sterling Winthrop, New York, NY)] at a dose of 2 ml/kg (maximum dose, 120 ml) was used in all patients.

Patients referred by trauma surgeon A or B were given oral contrast. Those referred by trauma surgeon C were given oral or nasogastric contrast [methylglucamine diatrizoate (Gastrografin) 1%] in a volume appropriate to age 0.5–1 h prior to CT scanning, and an additional dose immediately prior to scanning. Oral contrast was given to 116 children (45%) while 157 children (57%) did not receive oral contrast.