Primary omental torsion (POT) unrelated to any other intraabdominal lesion was first reported by Eitel1 in 1899. By 1981, 223 additional cases had been reported,2 mostly in adults. Many more cases have been reported since, including those occurring in children.3–9 Historically, ~0.1% of children undergoing laparotomy for suspected appendicitis have POT.3 Although it is a rare cause of abdominal pain in children, it has no distinguishing features to separate it from other causes of a surgical abdomen.3 POT seems to be less acute than with other causes of surgical abdomen.5

Although obesity has been recognized as a predisposing factor of POT and explains its greater frequency in adults,12 in the past 2 decades, the prevalence of obesity in children and adolescents has doubled.13 It has been suggested that the increased rate of pediatric obesity may result in an increase of POT in younger age groups.9

At our institution, we perceived an increase in cases of POT in the last 5 years. This observation prompted us to review the medical records of children with POT to determine what predisposing factors may have led to its rise and to delineate its clinical presentation in children.

METHODS
We reviewed the pathology specimen records designated “omentum” from January 1, 1993, to March 31, 2003, at the Kosair Children’s Hospital. All cases with primary omental infarction were identified, and their hospital charts were reviewed. Demographic data, history, and physical, laboratory, and histopathology findings were recorded. Cases with secondary omental torsion or other omental pathology such as omental cysts, hernias, tumors, and adhesions were excluded.

RESULTS
Among 41 987 pathology records reviewed, 136 pathology specimen records designated “omentum” were recorded during a 10-year period. POT was identified in 12 cases. The histopathology was reviewed, and all 12 cases were confirmed to have foci of hemorrhage and necrosis. During the same period, there were ~3300 appendectomies, a rate of POT of 1:275 appendectomies. The diagnosis in 8 (67%) of the 12 cases were made in the past 5 years. The majority of the patients were white (92%) males (75%). The children affected were predominantly (75%) in the 9- to 16-year age group; 3 were 3 to 4.5 years old. Weight percentiles were ≥95th in 11 (92%) of 12 patients, with 9 greatly >95th percentile. The body mass index (BMI) was calculated in 9 of 12 patients, and all were >85th percentile for age with 8 of the 9 >95th percentile. We were unable to calculate the BMI in 3 of the patients because the height was not documented in the medical record.

All children presented with abdominal pain of 1 to 5 days duration (mean of 3). It was localized in the right lower quadrant in 6, right upper quadrant in 5, and both right upper and right lower quadrant pain in 1 child. Only half of the children complained of anorexia. Nausea with vomiting was noted in only 2 patients, and nausea or vomiting was each observed in 1 child. No precipitating event was identified with the exception of 2 9-year-old children, 1 of whom was kicked in the abdomen 3 days before hospital admission and the other who ran into a wall, striking the right side of the abdomen. Body temperature on admission was normal in 7 children, 100.1°F to 100.9°F in 3, and 101°F in 2. Abdominal tenderness localized to the right side was noted in all the patients. The mean peripheral white blood cell count was 13.2/m3 (range of 8.8–19.5; see Table 1).
BMI ease Control. Adults with a BMI tile are overweight as defined by the Center for Dis-
lance of children with a BMI of 85th percentile for age are considered at risk for
from clinical measurements. Children with a BMI preferred method of expressing body fat percentile
able increase in the prevalence of children with ex-
inal pain in 90% of cases.4 When no predisposing
sion, the omentum is found twisted around the distal
vascular compromise. In most cases of omental tor-
long axis, causing venous obstruction, edema, and
predisposes the omentum to twist around its long
axis, leading to vascular compromise, infarction, and
gangrene.9

Similar to previous observations, we found that
obesity was a strong predisposing factor in all our
cases of POT. The preponderance of male children
with POT in our series lends further support of obe-
sity as a predisposing factor in that males have a
higher accumulation of omental fat than females at
the same total body weight.19 The children in our
series were all overweight and frankly obese (>95th
percentile BMI) in 89% of those whose BMI we were
able to calculate. They commonly presented with
pain on the right upper or lower abdomen. The
occurrence of pain in this location and the higher
incidence of right-sided omental torsion has been
attributed to an omentum that is longer and more
mobile on the right side.3 The location of the pain
mimics the presentation of acute appendicitis and
acute cholecystitis. Our findings of minimal or no
fever, anorexia in only half the cases, and peripheral
white blood cell counts that were elevated only
mildly are similar to the findings of previous re-
ports.5,6,9 The children appeared to be less ill-appear-
ing than other children undergoing evaluation of an
acute abdomen. A review of the literature on POT in
children also showed that the children had fewer
constitutional symptoms than those who had an in-
flamed appendix. The overall duration of the abdom-
inal pain ranged from 1 to 8 days, with an average of
3 days. Neither the symptoms nor the physical find-
ings present any characteristic pattern to suggest the
diagnosis, because any or all of these features are
common to several other acute abdominal diseases.12
Our cases occurred in the last decade: 4 in the first 5
years (1993–1998) and 8 in the last 5 years (1999–
2003). This is a doubling of POT occurrence coinci-
dent with the increasing prevalence of obesity in

**TABLE 1.** Clinical Presentation of Primary Omental Torsion at Kosair Children’s Hospital (University of Louisville), 1993–2003

<table>
<thead>
<tr>
<th>Year of Report</th>
<th>Race/Sex</th>
<th>Age (Years)</th>
<th>Weight (kg)</th>
<th>Weight (Percentile)</th>
<th>Height (cm)</th>
<th>BMI (Percentile)</th>
<th>BMI (Percentile)</th>
<th>Temp. (°F)</th>
<th>Pain</th>
<th>Duration (Days)</th>
<th>Anorexia</th>
<th>NVD*</th>
<th>WBC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>W/M</td>
<td>4.5</td>
<td>22</td>
<td>&gt;95th</td>
<td>95th</td>
<td>100.1</td>
<td>100.1</td>
<td>97</td>
<td>RLQ</td>
<td>2</td>
<td>Yes</td>
<td>No</td>
<td>8.8</td>
</tr>
<tr>
<td>1995</td>
<td>W/M</td>
<td>9</td>
<td>53</td>
<td>&gt;95th</td>
<td>95th</td>
<td>100.9</td>
<td>100.9</td>
<td>98</td>
<td>RUQ</td>
<td>5</td>
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<td>No</td>
<td>11.5</td>
</tr>
<tr>
<td>1996</td>
<td>W/F</td>
<td>3</td>
<td>28</td>
<td>&gt;95th</td>
<td>95th</td>
<td>100.8</td>
<td>100.8</td>
<td>97</td>
<td>RLQ</td>
<td>2</td>
<td>Yes</td>
<td>Yes, V</td>
<td>16.6</td>
</tr>
<tr>
<td>2000</td>
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<td>12</td>
<td>70.8</td>
<td>&gt;95th</td>
<td>95th</td>
<td>99.6</td>
<td>99.6</td>
<td>97</td>
<td>RLQ</td>
<td>1</td>
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<td>No</td>
<td>12.1</td>
</tr>
<tr>
<td>2001</td>
<td>W/M</td>
<td>9</td>
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<td>98.8</td>
<td>98.8</td>
<td>97</td>
<td>RUQ</td>
<td>3</td>
<td>No</td>
<td>No</td>
<td>12.4</td>
</tr>
<tr>
<td>2002</td>
<td>W/M</td>
<td>10</td>
<td>54.4</td>
<td>&gt;95th</td>
<td>95th</td>
<td>96.8</td>
<td>96.8</td>
<td>91</td>
<td>RUQ</td>
<td>5</td>
<td>No</td>
<td>Yes, NV</td>
<td>9.4</td>
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<tr>
<td>2003</td>
<td>W/F</td>
<td>10</td>
<td>47.8</td>
<td>&gt;95th</td>
<td>95th</td>
<td>97.8</td>
<td>97.8</td>
<td>91.1</td>
<td>RUQ/RLQ</td>
<td>2</td>
<td>No</td>
<td>No</td>
<td>10.8</td>
</tr>
</tbody>
</table>

NVD indicates nausea, vomiting, diarrhea; WBC, white blood count; W, white; AA, African American; RLQk, right lower quadrant; RUQ, right upper quadrant.

Computed tomography (CT) scan of the abdomen
was performed in 8 patients. All of the scans showed
evidence of inflammation in the omental fat on the
right side of the abdomen.

**DISCUSSION**

The greater omentum is a sheet of peritoneum that
hangs from the greater curvature of the stomach to
the adjacent organs. It is attached more firmly to
abdominal organs on the left side of the abdomen
and attaches itself to the diaphragm. The greater
omentum grows freely from the greater curvature of
the stomach and forms the 4-layered, fat-laden
omentum. The greater omentum is a sheet of peritoneum that
twists around its long
axis, causing venous obstruction, edema, and
vascular compromise. In most cases of omental tor-
sion, the omentum is found twisted around the distal
right epiploic artery, resulting in right-sided abdom-
nal pain in 90% of cases.4 When no predisposing
abnormality is found, omental torsion is considered
primary.

The exact etiology of POT is not known. Previous
reports suggested several predisposing factors in-
cluding anatomic variations and excess omental fat
associated with obesity.5,10 Trauma, straining, over-
eating, overexertion, and sudden positional change
were also implicated.10,14

Data derived from many sources show a remark-
able increase in the prevalence of children with ex-
cess body fat in the United States.13 The BMI is the
preferred method of expressing body fat percentile
from clinical measurements. Children with a BMI
>85th percentile for age are considered at risk for
being an overweight adult, and those >95th percent-
ile are overweight as defined by the Center for Dis-
ease Control. Adults with a BMI >95th percentile are
obese. The prevalence of American children with a
BMI >95th percentile has doubled between 1963 and
1991, along with an increase of ~50% in the preva-
lence of children with a BMI of >85%.13

Obesity causing irregularly distributed accumula-
tions of excess omental fat has been cited as a pre-
disposing cause of POT.5,10,12,15–18 A recent report by
Varjavandi et al9 presented 4 children with POT who
had BMI >95th percentile for age. They postulated
that increased fat deposit in obese children outstrips
the blood supply to the developing omentum, lead-
ing to either relative ischemia as the inciting event,
increased omental weight leading to torsion, or trac-
tion to the most distal parts of the omentum. The
heavily fat-laden omentum in these obese children
predisposes the omentum to twist around its long
axis, leading to vascular compromise, infarction, and
gangrene.9

Similar to previous observations, we found that
obesity was a strong predisposing factor in all our
cases of POT. The preponderance of male children
with POT in our series lends further support of obe-
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Our cases occurred in the last decade: 4 in the first 5
years (1993–1998) and 8 in the last 5 years (1999–
2003). This is a doubling of POT occurrence coinci-
dent with the increasing prevalence of obesity in
children in the United States as shown in the National Health and Nutrition Examination Survey of 1997–1991. A 30-year review (1951–1981) at the Hospital for Sick Children in Toronto, Canada, found an incidence of POT as 1:800 surgeries for acute appendicitis, whereas a 20-year review (1975–1994) at the Royal Children’s Hospital in Melbourne, Australia, had a POT rate of 1:600 appendectomies. Our more recent 10-year review (1993–2003) found POT in 12 of 3300 appendectomies, a rate of 1:275. The increasing prevalence of POT in children seems to coincide with the increased prevalence of obesity in children. However, common use of CT imaging in children with abdominal pain may, in part, account for the increase in diagnosis of POT. Omental torsion has a classic finding on CT scan. The infarcted omentum appears as an area of high-attenuated fat containing hyperattenuated streaks just beneath the parietal peritoneum with thickening of the overlying anterior abdominal wall. Preoperative diagnosis with the use of CT scan was possible in 8 of 12 of our cases.

A typical ultrasound scan appearance has also been described, with the infarcted omentum appearing as a hyperechoic, noncompressible, ovoid intraperitoneal mass adherent to the anterior abdominal wall with localized point tenderness. A definite history of trauma to the abdomen preceding the onset of symptoms had been reported in a few cases including 1 involving a 7-year-old boy kicked in the abdomen 6 days before laparotomy. Two of our cases had traumatic precipitating events; both children were obese.

Obesity seems to be a major risk factor in the development of POT in children. POT should be considered in the differential when assessing abdominal pain in obese children, especially those who are not ill-appearing. A high index of suspicion and an abdominal CT scan help to make an early preoperative diagnosis.

The increase in childhood obesity in our nation has reached epidemic proportions. POT is just one of the disorders that add to the morbidity of the obese child. As child advocates, the onus on obesity prevention, identification, and intervention rests on the primary care physician.

REFERENCES


Childhood Obesity: A Risk Factor for Omental Torsion
Judy A. Theriot, Jon Sayat, Sofia Franco and John J. Buchino
Pediatrics 2003;112;e460
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