

## Phytobezoars in the Small Intestine : CT and US Appearances<sup>1</sup>

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**Purpose :** To describe CT and ultrasound (US) appearances of phytobezoar in the small intestine.

**Materials and Methods :** During the past two years, CT and US scans of six patients with phytobezoars of the small intestine were retrospectively reviewed. All patients presented symptoms of bowel obstruction, and four had a history of gastric surgery. Four phytobezoars were found in the jejunum and two in the ileum at surgery. We evaluated CT and US findings of phytobezoar and compared these with CT images of the removed phytobezoars.

**Results :** In three patients, US studies showed a curvilinear echogenic mass within the lumen of the dilated small bowel, with a clear posterior acoustic shadow. In six, CT scans revealed an intraluminal mass seen as having a thin soft tissue rim at the periphery and numerous aggregated low attenuation areas representing gas in the central portion. CT findings of the specimens were the same as those of phytobezoars in vivo.

**Conclusion :** US and CT appearances of small intestinal phytobezoars are sufficiently distinctive to advocate the preoperative routine use of US and CT for diagnosing this entity.

### Index Words : Bezoar

Intestines, CT

Intestines, stenosis or obstruction

Phytobezoars result from ingestion of vegetable and plant material of certain types. By far the most common cause is the persimmon (1, 2). It has been recognized that phytobezoar formation is common after a gastric operation, and causes gastric ulceration, bleeding, and gastrointestinal obstruction. Phytobezoars are likely to pose diagnostic difficulties in surgical patients when they enter into the differential diagnosis of disorders that cause abdominal pain and small bowel obstruction, particularly in patients who have previously undergone a gastric operation.

Several reports have described the radiographic findings of phytobezoar after the administration of a

barium study, but few have described ultrasound (US) appearances (3, 4, 5). To evaluate the usefulness of US and CT in diagnosing this entity, this report reviews the US and CT features of small intestinal phytobezoars in six patients.

### Materials and Methods

Over a recent two-year period, phytobezoars obstructing the small intestine were confirmed at surgery in eight patients. Six of these, who had undergone either CT or US scans, form the basis of this study. Four were men and six were women; their ages ranged from 35 to 87 (mean, 51). CT (n=6) or US (n=3) images, including clinical findings, were retrospectively reviewed. All patients reported abdominal pain, vomiting and indigestions, symptoms suggestive of intestinal obstruction. Four of the six had a previous history of gastric surgery for peptic ulcer between one

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and thirty years before admission. Of the other two with no such history, one was diabetic. Four patients had a recent history of persimmon ingestion. Phytobezoar was founded only in the small bowel of four patients, and in the stomach and small bowel of two. At surgery, four phytobezoars were found in the jejunum and two in the ileum.

In all patients, CT scans were obtained by using GE 9800 or High Speed Advantage (General Electric, Milwaukee, Wisconsin) and other third generation CT scanners. After intravenous bolus injection of nonionic contrast material (Ultravist-300, Schering, Berlin, Germany), images were obtained with 10mm thickness and at 10mm intervals from the level of the dome of the liver to the pelvis. Two removed phytobezoars were also scanned with 3–5 mm thickness and at the same intervals. In three patients, sonographic examination was performed with a 3.5 or 5.0MHz sector or linear transducer (Spectra, Diasonics, Milpitas, USA). The CT and US appearances of small intestinal bezoars were analysed and compared with radiographic findings of the specimen.

## Results

### US findings

In all three cases, US examination of the abdomen demonstrated multiple fluid-filled, dilated, hyperperistaltic small bowel loops, ascites and an intraluminal echogenic mass. (Fig. 1A, 2A). The masses were seen as a hyperechoic arc with a clear posterior acoustic shadow.

### CT findings

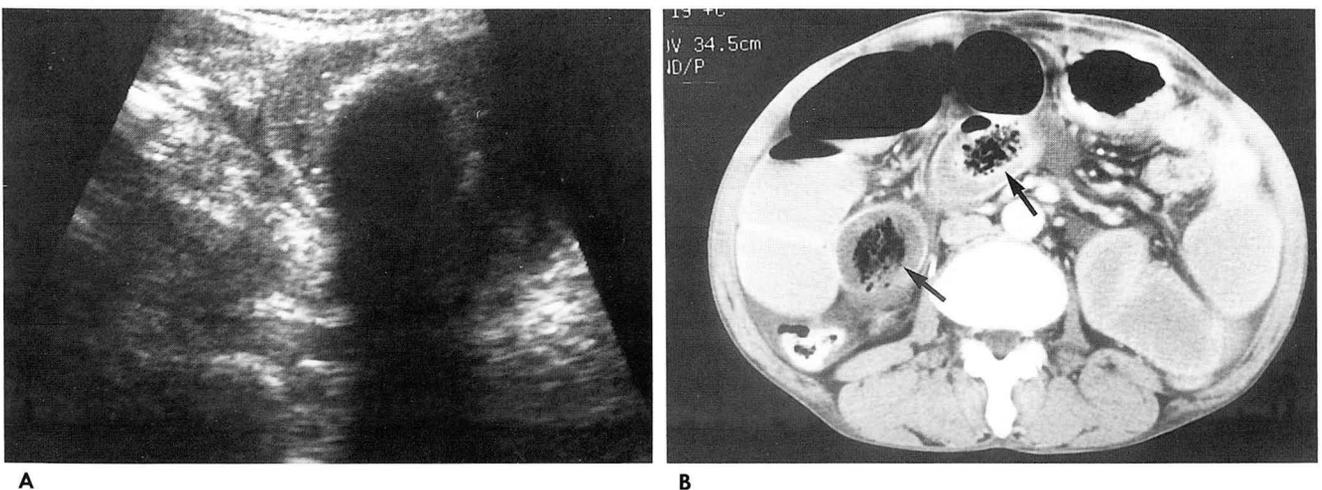
In all six cases, CT showed well-marginated round or oval intraluminal masses, with a relatively homogeneous thin soft tissue portion at the periphery and an aggregation of numerous tubular or round low attenuation areas in the central portion (Fig. 1B, 2B). The peripheral portions of the mass were less than 3 mm thick and their mean attenuation number was 40HU. The density of the central portion was about -200HU, suggesting that air was trapped within the mass. Small bowel loops proximal to the mass were dilated and filled with fluid. Mean bezoar diameter was 5 cm (range, 3–8 cm).

### CT findings of the specimens

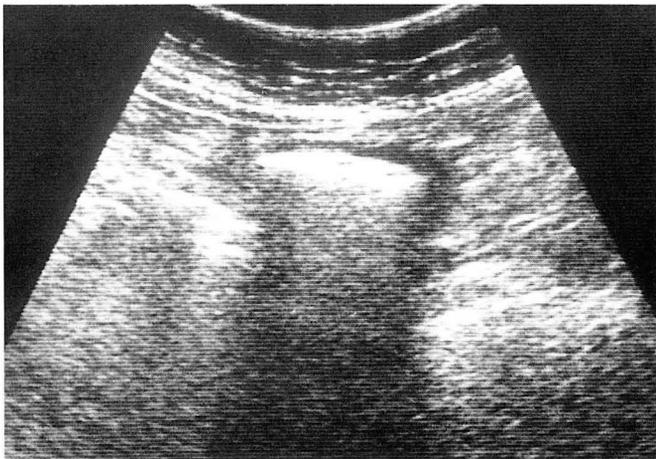
In two patients, CT of the specimen, revealed a soft tissue mass mixed with multiple irregular low attenuation areas representing gas (-200~-400 HU). These CT findings of the specimens were the same as those of phytobezoars in vivo (Fig. 2C).

## Discussion

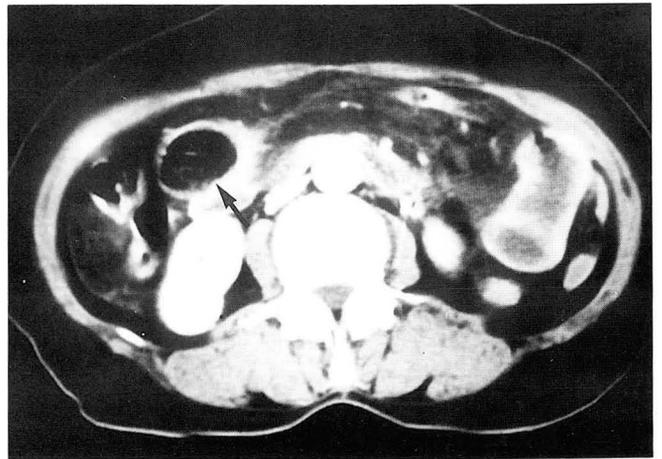
A phytobezoar is a large conglomerate of vegetable fibers. The formation of a persimmon phytobezoar is due to a soluble tannin termed shibuol, which forms a glue-like coagulum when astringent unripe fruit comes in contact with dilute hydrochloric acid in the stomach. The unripe fruit is found to contain a high concentration of the tannin monomer that undergoes polymerization in the stomach, resulting in a tannin-cellulose-hemicellulose-protein complex (1).



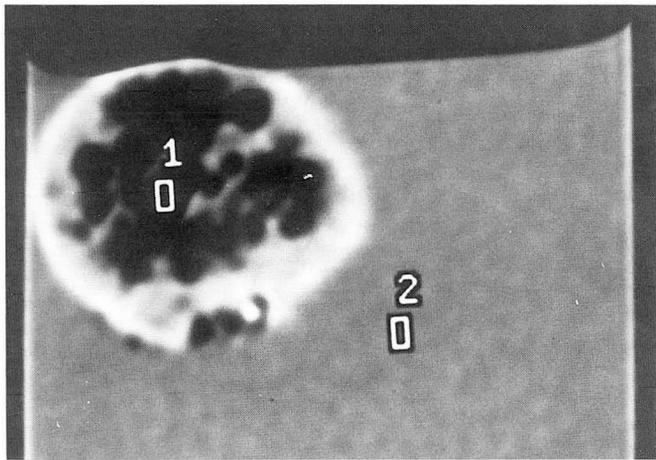
**Fig. 1.** A 58-year-old man with intermittent abdominal pain, vomiting, and constipation for a week.  
**A.** Transverse sonogram of right mid abdomen shows a hyperechoic, arc-like echo within the lumen of the ileum with clear posterior acoustic shadow.  
**B.** Contrast enhanced axial CT scan at the level of mid abdomen shows two intraluminal masses (arrows) with multiple low attenuation areas in the ileum and markedly distended proximal small bowel loops.



A



B



C

**Fig. 2.** A 66-year-old woman with abdominal pain and vomiting for a day.

**A.** Transverse sonogram of the lower abdomen shows a hyperechoic structure along the anterior wall of the mass with a posterior acoustic shadow within the lumen of the jejunum.

**B.** Contrast enhanced axial CT scan at the level of the right kidney shows 3cm-size intraluminal mass (arrow) in the jejunum. The mass was seen as a low attenuation mass with thin septations.

**C.** Specimen CT scan shows a mass with relatively homogeneous soft tissue density portion in periphery and aggregated numerous low attenuation areas in inner portion.

Phytobezoar formations have commonly been found after a gastric operation, particularly where bilateral truncal vagotomy plus pyloroplasty has been employed, and in hypomotility disorders of the stomach (4). The reasons for this are still not clear. Vagotomy, by reducing gastric acidity and motility, retarding gastric emptying and lengthening the exposure of gastric contents to dilute hydrochloric acid, may enhance the formation of phytobezoar. The drainage procedure, pyroloplasty or gastroenterostomy, eliminates pyloric sphincter function and facilitates the passage of large bezoars into the small bowel, and this may lead to intestinal obstruction. An intact pylorus usually prevents the transition of food particles large enough to obstruct the small bowel (6, 8).

In four cases, a history of persimmon ingestion was obtained one day to several weeks before the onset of symptoms; two patients had no history of previous gastric operation or persimmon ingestion. Diagnosis of phytobezoar is rarely made before surgical intervention, since phytobezoar is radiolucent and clinical symptoms and plain radiographs are similar to those of

intestinal obstruction by other causes. US or CT may be utilized in patients with small bowel obstruction, especially when there is no history of previous gastric operation or persimmon ingestion.

Sonographically, phytobezoars were seen as an intraluminal mass with a hyperechoic arc-like surface echo casting a clear posterior acoustic shadow, as described in several case reports (4, 5, 9). The obstructed small bowel loops usually contained a large amount of air, and so phytobezoars could be overlooked if sonographic examination was not meticulously performed.

CT showed phytobezoar as an intraluminal mass of homogeneous soft tissue attenuation with aggregated low attenuation areas in the center. A lower resolution CT scanner, however, may show it as a round or oval mass with a central low attenuation area. An aggregation of numerous low attenuation areas may be seen as one large low attenuation area.

The curvilinear echogenic intraluminal mass with a clear postacoustic shadow on US and CT findings seen in our study may be specific for diagnosis of small in-

testinal phytobezoar. Especially in patients with no previous history of gastric operation, persimmon ingestion, or diabetes mellitus, these findings could be a clue to the specific cause of bowel obstruction. Bezoars are much less likely to respond to conservative methods, and to prevent decubitus ulceration and pressure necrosis of the bowel wall, early surgery is recommended.

In conclusion, US and CT appearances of small intestinal phytobezoars are sufficiently distinctive to advocate the preoperative routine use of US and CT for diagnosing this entity.

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소장 위석의 전산화 단층촬영 및 초음파 소견<sup>1</sup>

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목 적 : 소장위석의 전산화 단층촬영 및 초음파검사 소견을 분석하고자 하였다.

대상 및 방법 : 최근 2년간 수술로서 확진된 6예의 소장위석의 전산화 단층촬영 및 초음파 검사 소견을 후향적 방법으로 분석하였다. 모든 환자에서 소장 폐쇄를 시사하는 증상이 있었으며 4예는 위절제술을 받은 과거력이 있었다. 4예는 공장예, 2예는 회장에 위석이 있었다. 소장 위석이 취하는 특징적인 방사선학적 소견을 알아보고, 수술 후 얻은 위석의 전산화 단층촬영 소견과 비교하였다.

결 과 : 초음파 검사를 시행한 3예 모두에서 소장 위석은 늘어난 장관내에, 위쪽으로 불룩한 띠모양의 고에코를 보이며, 뒤쪽으로 음영그림자가 동반된 종괴로 보였으며, 6예의 전산화 단층촬영에서 소장 위석은 경계가 명확한 장관내 종괴로 가장자리는 보다 고음영의 테두리를 가지고, 안쪽으로는 수많은 작은 공기 음영들이 모인 양상이었다. 2예의 수술로 제거한 위석의 전산화 단층촬영에서도 같은 양상을 보였다.

결 론 : 전산화 단층촬영과 초음파 검사에서 소장 위석은 특징적인 소견을 가지므로, 소장 위석의 수술전 진단에 전산화 단층촬영이나 초음파 검사의 이용을 권장한다.