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Original Article

Radiology Section

Distinct Radiological and Clinical Characteristics of Intestinal Perforation caused by Jujube Pits and Fishbones: A Retrospective Observational Study

YI-ZHI ZHAO[1], XUE-XIA SHENG[2], LONG XU[3], YU-CHENG QIAN[4], ZHI-GANG MIN[5]

ABSTRACT

Introduction: Jujube pits and fishbones are common ingested foreign bodies leading to intestinal perforation. Their clinical presentation is often atypical, with patients frequently lacking a history of ingestion and less than 50% showing pneumoperitoneum on plain films. Accurate diagnosis is challenging, emphasising the critical role of radiologists and Computed Tomography (CT) imaging.

Aim: To compare the clinical and imaging characteristics of intestinal perforations caused by jujube pits and fishbones.

Materials and Methods: The present retrospective analysis was conducted on patients with surgically or endoscopically confirmed perforations caused by jujube pits (n=17) and fishbones (n=15) in the Affiliated Yixing Hospital of Jiangsu University, Yixing, Jiangsu, China, between January 2016 to September 2024. All patients underwent conventional or contrast-enhanced CT scans using dual-source 64-slice scanners. Imaging parameters included Multiplanar Reconstructions (MPRs), Maximum Intensity Projection (MIP), and Volume Rendering (VR). Clinical and imaging features, including foreign body type, location, intestinal wall thickening, and pneumoperitoneum, were analysed. Numerical data and categorical variables were compared using student's t-test and Chi-square test, respectively.

Results: Patients in the jujube pit group were older than those in the fishbone group (77.3±17.0 vs. 66.9±14.7 years). A marked female predominance was observed in the jujube pit group (male: female ratio 3:14), contrasting with the relatively balanced gender distribution in the fishbone group (7:8). However, neither age nor gender distribution showed statistically significant differences between the groups. The jujube pit group exhibited significantly higher White Blood Cell (WBC) counts ($13.8\pm4.3\times10^9$/L vs. $10.5\pm3.9\times10^9$/L, p=0.033) and more frequent bowel oedema (15/17 vs. 6/15, p=0.008) and fatty infiltration (16/17 vs. 9/15, p=0.027) compared to the fishbone group. The ileum was the most common perforation site (66%). Surgical management was required in 29 cases (72% primary repair, 28% resection), with three fishbone cases treated endoscopically. The jujube pit group had significantly longer hospital stays (p<0.05).

Conclusion: Jujube pits cause more severe inflammatory responses and tissue damage than fishbones, often necessitating surgical intervention. Recognising these differences can guide appropriate treatment strategies for intestinal perforations caused by these foreign bodies.

Keywords: Computed tomography, Ingested foreign bodies, Intestinal perforation

INTRODUCTION

Jujube pits and fishbones are among the most commonly ingested foreign bodies, leading to intestinal perforation. Compared to other causes of non-traumatic intestinal perforation, the clinical presentation of perforation caused by foreign bodies is often atypical. Patients frequently lack a clear history of foreign body ingestion, and less than 50% exhibit pneumoperitoneum on abdominal plain films [1]. These factors complicate the diagnostic process for Emergency Physicians. Accurate preoperative diagnosis is essential for selecting the appropriate treatment approach. Consequently, Radiologists play a critical role in accurately identifying imaging features and providing precise diagnoses. CT and its associated reconstructions are the most valuable tools for diagnosing and locating foreign bodies [2]. Several reports have documented management approaches for fishbone-induced intestinal perforation, with open surgical intervention being the most common approach, followed by endoscopic treatment and conservative management in select cases [1,3-5]. In contrast, limited data exist regarding optimal treatment strategies for jujube pit-induced intestinal perforation [6,7]. Li F et al., reported a case series of 18 patients with jujube pit-induced gastrointestinal perforations, of which 15 underwent surgical intervention while three were managed conservatively [7]. Currently, it remains unclear whether similar treatment algorithms should be applied for perforations caused by these two distinct types of foreign bodies. The present study aimed to compare the clinical and imaging features of intestinal perforations caused by these two foreign bodies to facilitate correct diagnosis and treatment.

MATERIALS AND METHODS

The present retrospective observational study was approved by the Institutional Review Board of the hospital (NO.2025112). Data was retrieved from patients with surgically or endoscopically confirmed intestinal perforations caused by jujube pits or fishbones between January 2016 and September 2024.

Inclusion and Exclusion criteria: The inclusion criteria comprised of cases with confirmed intestinal perforation due to either jujube pits or fishbones, as verified by surgery or endoscopy. Exclusion criteria were: Intestinal perforations caused by other foreign bodies and cases with significant CT image artifacts that impaired diagnostic assessment. Based on these criteria, three cases were excluded which involved perforations caused by other foreign bodies and one case where CT artifacts substantially hindered evaluation. Ultimately, the study cohort consisted of 17 patients with jujube pit-induced perforations and 15 patients with fishbone-induced perforations.

Study Procedure

CT imaging was performed using a dual-source 64-slice scanner (Siemens Medical Systems, Germany) or a 64-slice scanner (Toshiba).

Contrast-enhanced images were acquired after intravenous injection of 1.5 mL/kg of iopromide (Ultravist 370; Bayer Schering, Berlin, Germany) at a flow rate of 3-5 mL/s. Scanning parameters included a Field Of View (FOV) of 40 × 40 cm, a matrix size of 512 × 512, and a slice thickness of 1 mm. MPRs, MIP, and VR were performed to assess the complete morphology of the foreign bodies.

Clinical presentations including abdominal pain duration, peritoneal signs, fever, nausea/vomiting were systematically evaluated, along with laboratory parameters (WBC count and neutrophil percentage). Radiological assessment focused on foreign body localisation, intestinal wall oedema, pneumoperitoneum, and signs of intestinal obstruction. Clinical and imaging characteristics were compared between the two patient groups (jujube pits and fishbones).

STATISTICAL ANALYSIS

Numerical data and approximately normally distributed data were analysed using student's t-test. Categorical variables were compared using the Chi-square test or Fisher's-exact test (for small samples or highly imbalanced table cells). Statistical analyses were conducted using Statistical Package for Social Sciences (SPSS) software (version 22; IBM, Armonk, NY, USA), with a two-sided $p<0.05$ considered statistically significant.

RESULTS

The patients' ages ranged from 31 to 92 years, with no significant difference in average age between the two groups. The sex ratio was also similar, although the jujube pit group had a slightly higher proportion of female patients. The WBC count in the jujube pit group ($13.8\pm4.3\times10^9$/L) was significantly higher than in the fishbone group ($10.5\pm3.9\times10^9$/L) ($p=0.033$). No significant differences were observed in the duration of abdominal pain or neutrophil proportion (N%) between the groups. Detailed findings are summarised in [Table/Fig-1].

Parameters		Jujube pit	Fishbone	Total	Chi-square and t value	p-value
Gender	Male	3	7	10	$\chi^2=3.124$	0.128
	Female	14	8	22		
Age (years)		73.3±17.0	66.9±14.7	70.3±16.1	t=1.123	0.270
Abdominal pain duration (hours)		28.5±40.9	29.7±35.4	29.1.0±37.8	t=.093	0.927
Peritonitis	Yes	14	8	22	$\chi^2=3.124$	0.128
	No	3	7	10		
Nausea and vomiting	Yes	8	6	14	$\chi^2=0.161$	0.735
	No	9	9	18		
Fever	Normal (<37.3°C)	6	8	14	$\chi^2=2.838$	0.242
	Low-grade (37.3°C-38.0°C)	6	6	12		
	Moderate-grade (38.1°C-39.0°C)	5	1	6		
WBC (10^9/L)		13.8±4.3	10.5±3.9	12.2±4.4	t=2.241	0.033
Neutrophils proportion		85.1±9.4	80.7±8.8	83.0±9.3	t=1.367	0.182

[Table/Fig-1]: General characteristics and clinical data comparison of patients with jujube pit and fishbone perforation.

CT imaging revealed jujube pits and fishbones either lying adjacent to or penetrating the intestinal wall. Jujube pits appeared as hollow, spindle-shaped hyperdense objects [Table/Fig-2,3], while fishbones appeared as linear or curvilinear hyperdense objects [Table/Fig-4-6]. The average length of jujube pits causing perforation was 3.0±0.3 cm, similar to that of fishbones (3.1±0.7 cm). The ileum was the most common perforation site (21 cases), followed by the sigmoid colon, transverse colon, duodenum, and jejunum [Table/Fig-7].

Among the 29 patients who required surgical intervention (either open or laparoscopic approach), 21 (72.4%) were treated with foreign body extraction and primary intestinal wall repair, while 8 (27.6%) underwent segmental intestinal resection. Additionally, three cases of fishbone-induced perforation were successfully managed endoscopically. Comparative analysis revealed significantly longer hospitalisation durations in the jujube pit group compared to the fishbone cohort ($p<0.05$) [Table/Fig-8].

During the minimum 3-month follow-up period, all conscious patients demonstrated favourable recovery without complications. A single mortality case occurred in an 80-year-old female from the jujube pit group with pre-existing cerebral infarction. This patient developed aspiration-induced cardiopulmonary arrest at disease onset, subsequently progressing to septic shock.

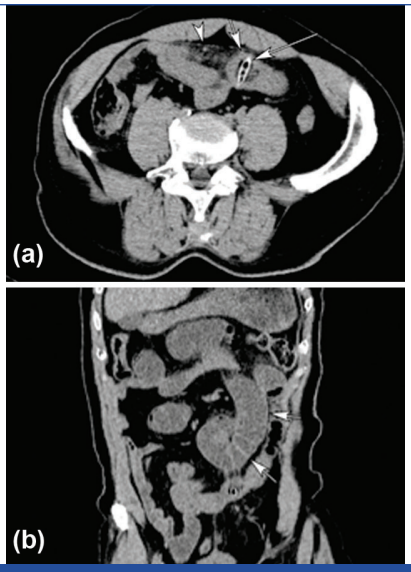
DISCUSSION

Jujubes, a traditional Chinese food believed to enhance physical fitness, have sharp ends that facilitate intestinal wall penetration [7]. Fishbones are another common cause of intestinal perforation [1]. CT is a sensitive and accurate imaging modality for identifying perforations caused by ingested foreign bodies [7]. Key imaging features include intestinal wall thickening, fatty infiltration, bowel obstruction, pneumoperitoneum, and identification of the foreign body within the intestinal loops [1]. However, this study highlights previously unreported differences in clinical and imaging manifestations between perforations caused by jujube pits and fishbones.

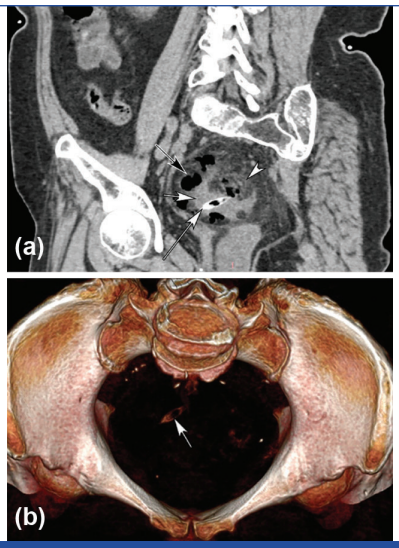
Patients with jujube pit perforation exhibited higher WBC counts, suggesting more severe inflammatory responses. Intestinal wall edema and fatty infiltration were also more pronounced in the jujube pit group, indicating greater mechanical damage and intestinal wall injury [8]. These findings suggest that jujube pits cause more significant tissue damage, often necessitating surgical intervention. In contrast, some fishbone perforations resulted in milder injuries, consistent with micro-perforations that may be amenable to non-surgical management [3-5]. Accurate identification of the causative foreign body is therefore crucial for treatment selection [9].

Despite the more severe tissue damage caused by jujube pits, their detection on CT can be as challenging as that of fishbones. Foreign body detection depends on size, density, and orientation. Subtle fishbones may be obscured by intestinal contents, while jujube pits, with lower attenuation than fishbones, can also be difficult to identify [1]. When foreign bodies are not parallel to the scanning plane, CT reconstructions and appropriate window settings can enhance detection [10].

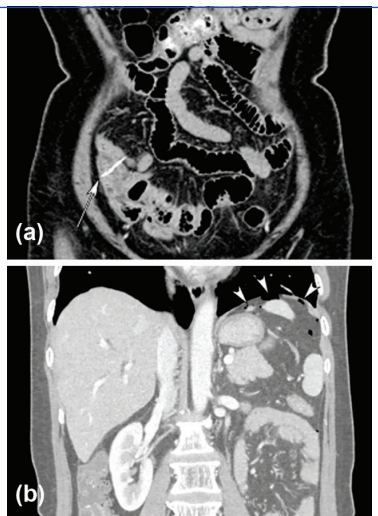
In the present study, the ileum was the most common perforation site for both jujube pits and fishbones, consistent with previous research [7,8]. The average length of the foreign bodies causing perforation (approximately 3 cm) slightly exceeds the typical width of the small intestine, making them more likely to become lodged and penetrate the intestinal wall during peristalsis [11].



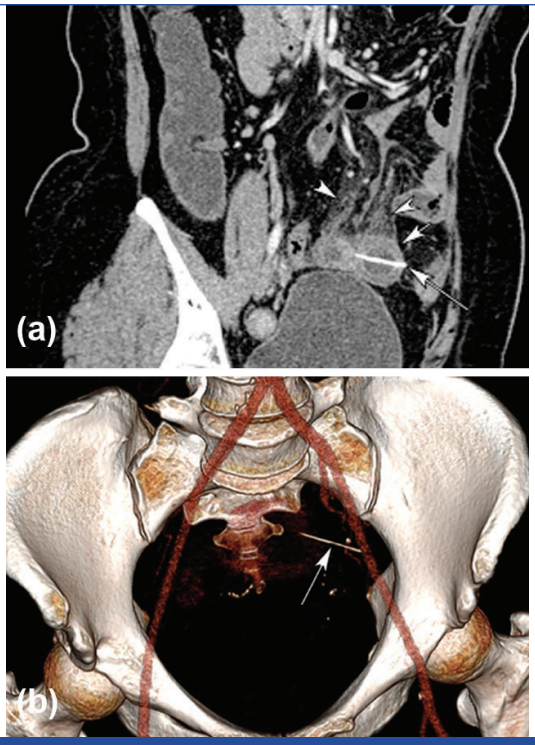
[Table/Fig-2]: CT scan of a 65-year-old male presenting with abdominal pain. Axial CT image: (a) reveals a spindle-shaped shadow (long arrow) lodged within the ileum, accompanied by intestinal wall oedema (short arrow) and fat infiltration (arrowhead); (b) Coronal CT MPR demonstrates small intestinal obstruction (short arrow). No pneumoperitoneum is observed on the CT images. Surgical intervention confirmed the foreign body as a jujube pit.



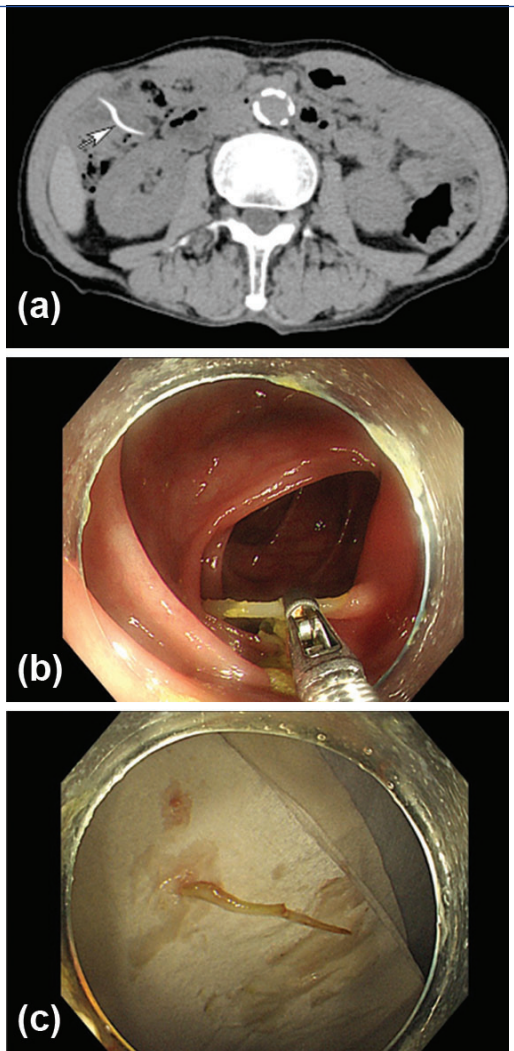
[Table/Fig-3]: A 73-year-old female presenting with abdominal pain. Oblique coronal CT Multiplanar Reconstruction (MPR): (a) shows a spindle-shaped shadow (long arrow) in the sigmoid colon, accompanied by colonic wall oedema (short arrow), fat infiltration (arrowhead), and localised pneumoperitoneum (black arrow). CT VR (b) clearly displays the hollow spindle-shaped foreign body, identified as a jujube pit.



[Table/Fig-4]: A 58-year-old female presenting with abdominal pain. Coronal CT Multiplanar Reconstruction (MPR): (a) reveals a hyperdense linear foreign body (arrow) in the ileum. Another coronal CT Multiplanar Reconstruction (MPR); (b) shows subdiaphragmatic free gas (arrowhead). Surgical findings confirmed the foreign body as a fishbone.



[Table/Fig-5]: A 48-year-old female presenting with abdominal pain after consuming fish. Oblique coronal CT MPR: (a) demonstrates a hyperdense linear foreign body (long arrow) in the ileum, accompanied by intestinal wall oedema (short arrow) and fat infiltration (arrowhead); CT VR (b) clearly displays the hyperdense fishbone (long arrow).



[Table/Fig-6]: A 71-year-old male presented with abdominal pain. Axial CT imaging (a) demonstrated a hyperdense, curvilinear foreign body (arrow) within the transverse colon. Subsequent endoscopic examination revealed the foreign body penetrating the colonic wall (b). The object, later identified as a fishbone (c), was successfully retrieved via endoscopy.

CT signs		Jujube pit	Fishbone	Total	Chi-square and t value	p-value
Length of foreign body ingested (cm)		3.0±0.3	3.2±0.8	3.1±0.5	t=0.699	0.498
Location	Duodenum	1	0	1	χ^2=5.581	0.233
	Jejunum	0	2	2		
	Ileum	12	9	21		
	Transverse colon	0	3	3		
	Sigmoid colon	4	1	5		
Bowel oedema	Yes	15	6	21	χ^2=8.219	0.008
	No	2	9	11		
Pneumoperitoneum	Free	4	3	7	χ^2=1.126	0.569
	Localised	7	4	11		
	No	6	8	14		
Ascites	Yes	7	5	12	χ^2=0.209	0.726
	No	10	10	20		
Fatty infiltration	Yes	16	9	25	χ^2=5.428	0.033
	No	1	6	7		
Intestinal obstruction	Yes	9	7	16	χ^2=0.125	1.000
	No	8	8	16		

[Table/Fig-7]: Comparison of CT signs between patients with jujube pit and fishbone perforation.

Parameters		Jujube pit	Fishbone	Chi-square and t value	p-value
Treatment process	LRFBR	5	7	χ^2=6.512	0.089
	LFBRIR	7	2		
	EFR	0	3		
	OPE	5	3		
Surgical Duration (Min)		92.4±28.2	70.7±28.2	t=2.169	0.038
Blood loss (mL)		43.8±26.9	30.3±28.7	t=1.372	0.180
Length of stay (days)		15.5±3.9	12.1±3.2	t=2.620	0.014

[Table/Fig-8]: A comparison of the patient's treatment status and prognosis.
LRFBR: Laparoscopic removal of foreign body and bowel repair; LFBRIR: Laparotomy for foreign body removal and intestinal repair; EFR: Endoscopic foreign body removal; OPE: Open partial enterectomy.

Free pneumoperitoneum was observed in only seven patients, aligning with prior studies [7,8]. The absence or limited presence of free gas can result in a negative pneumoperitoneum sign on plain abdominal films, which are of limited diagnostic value for intestinal perforation. CT with MPR offers superior diagnostic accuracy for perforations caused by ingested foreign bodies [9,12]. In rare cases, foreign bodies may completely penetrate the intestinal tract and involve adjacent organs [2]. One such case in the present study involved a fishbone fully penetrating the intestine, enveloped by inflammatory tissue without affecting surrounding organs.

Limitation(s)

The present study has several limitations. First, the small sample size (32 patients total: 17 with jujube pits and 15 with fishbones) results in limited statistical power, particularly for subgroup analyses. Second, its retrospective design may introduce selection bias, and there is a risk of incomplete data collection, which may not be fully addressed in the methods. Finally, being conducted at a single institution in China, where jujube consumption is common, the findings (especially regarding jujube pits) may have limited generalisability to other geographic regions or populations with different dietary habits.

CONCLUSION(S)

Significant differences in intestinal wall oedema, fatty infiltration, and WBC counts were observed between perforations caused by jujube pits and fishbones. Recognising these differences can aid in accurate diagnosis and guide appropriate treatment strategies.

Author contributions: All the authors contributed to the conception and design of the study. The material preparation, data collection, and analysis were performed by YZ, XS, LX, and YQ. The first draft of the manuscript was written by YZ and ZM, and all authors commented on the previous versions. All authors have read and approved the final manuscript.

Compliance with Ethical standards: This retrospective study involving human participants was in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The Institutional Review Board of Yixing Hospital Affiliated to Jiangsu University approved this study.

REFERENCES

[1] Li D, Zeng W, Chen J. Fish bone migration: Complications, diagnostic challenges, and treatment strategies. World J Emerg Surg. 2025;20(1):35. Doi: 10.1186/s13017-025-00611-9.

[2] GS ES, Gomes NBN, Pacheco EO, Bezerra FMR, Nunes RB, McPhee HL, et al. Emergency CT of abdominal complications of ingested fish bones: What not to miss. Emergency Radiology. 2021;28(1):165-70.

[3] Husain R, Alghamdi DA, Ghzoi FA, AlArafah SK, Bahammam MA, Al Duhileb M. Conservative management of fish bone-induced large bowel perforation: Case report. International Journal of Surgery Case Reports. 2022;95:107157.

[4] Al-Mulla A-M, Alshaheen M, Al-Huzaim M, Ks A-A, Al Mulla A. Conservative management in two penetrating fishbone injuries: A case series and literature review. Journal of Clinical and Medical Research. 2021;3(6):01-06.

[5] Ueda T, Sato H, Ogimi T, Deguchi R, Suzuki H. Use of endoscopy to remove fish bone that caused sigmoid colon perforation. Intern Med. 2024;63(19):2626-30.

[6] Ma Z, Chen W, Yang Y, Xu Z, Jiang H, Zhang Y, et al. Successful colonoscopic removal of a foreign body that caused sigmoid colon perforation: A case report. J Int Med Res. 2021;49(2):300060520982828.

[7] Li F, Zhou X, Wang B, Guo L, Ma Y, Wang D, et al. Intestinal perforation secondary to pits of jujube ingestion: A single-center experience with 18 cases. World Journal of Surgery. 2019;43(5):1198-206.

[8] Villanueva Campos AM, Martínez Rodríguez C, Tardáguila de la Fuente G, Utrera Pérez E, Jurado Basildo C. Gastrointestinal perforation caused by ingested fish bone. Computed tomography findings in 58 patients. Radiologia. 2020;62(5):384-91.

[9] Deniz MA, Turmak M. CT Evaluation of swallowed foreign bodies located in the gastrointestinal system. Cureus. 2022;14(6):e26355.

[10] Cicero G, Caloggero S, Cavallaro M, Frosina L, Visalli C, Ascenti V, et al. Ongoing computed tomography appraisal of intestinal perforation due to an ingested foreign body. Am J Case Rep. 2019;20:635-39. Doi: 10.12659/AJCR.915290.

[11] Kumar D, Venugopalan Nair A, Nepal P, Alotaibi TZ, Al-Heidous M, Blair Macdonald D. Abdominal CT manifestations in fish bone foreign body injuries: What the radiologist needs to know. Acta Radiologica Open. 2021;10(7):20584601211026808.

[12] Taguchi T, Kitagawa H. Fish bone perforation. N Engl J Med. 2019;381(8):762. Doi: 10.1056/NEJMicm1900442.

PARTICULARS OF CONTRIBUTORS:
1. Faculty, Department of Radiology, The Affiliated Yixing Hospital of Jiangsu University, Yixing, Jiangsu, China.
2. Faculty, Department of Radiology, The Affiliated Yixing Hospital of Jiangsu University, Yixing, Jiangsu, China.
3. Faculty, Department of Radiology, The Affiliated Yixing Hospital of Jiangsu University, Yixing, Jiangsu, China.
4. Faculty, Department of Radiology, The Affiliated Yixing Hospital of Jiangsu University, Yixing, Jiangsu, China.
5. Faculty, Department of Radiology, The Affiliated Yixing Hospital of Jiangsu University, Yixing, Jiangsu, China.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Zhi-Gang Min,
No.1588, Xincheng Road, Yixing, Jiangsu, China.
E-mail: minzhigang1980@163.com

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