
UNIVERSITE DE LAUSANNE – FACULTE DE BIOLOGIE ET DE MEDECINE

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Migrated foreign body liver abscess
illustrative case report, systemic review
and proposed diagnostic algorithm

THESE

préparée sous la direction du Professeur associé Gian Dorta

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par

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*Migrated foreign body liver abscess. Illustrative case report,
systematic review, and proposed diagnostic algorithm*

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Rapport de synthèse

Contexte : l'abcès pyogénique du foie est une infection grave et un défi thérapeutique. L'échec de traitement peut être dû à un corps étranger ingéré passé inaperçu qui a migré du tractus gastro-intestinal au foie. Il y a eu récemment eu une augmentation marquée du nombre de cas rapporté. Toutefois, l'abcès est initialement faussement considéré comme cryptogénique dans la majorité des cas, encore actuellement. Nous avons entrepris cette étude pour caractériser cette entité et fournir une stratégie diagnostique applicable au niveau mondial.

Méthode : nous avons rassemblé les données de notre cas et d'une revue systématique de 59 cas bien décrits. Par ailleurs, deux autres revues systématiques d'abcès du foie cryptogénique et d'abcès du foie à *Klebsiella* originaire d'Extrême-Orient ont été conduites; les données de ces revues ont été comparées aux données du cas d'abcès du foie à corps étranger. **Résultats :** l'anamnèse, l'imagerie moderne (scanner : CT et ultrason : US) et même l'exploration chirurgicale ont une sensibilité diagnostique insuffisante, nous avons donc développé un nouvel algorithme diagnostique.

Une fistule entre l'abcès et le tractus digestif, trouvée par imagerie ou endoscopie impose une exploration chirurgicale. De plus, des symptômes de perforation gastro-intestinale, la mise en évidence au CT d'une paroi gastro-intestinal épaissie en contact avec l'abcès ainsi que des adhérences entre le foie et le tractus digestif vues pendant la chirurgie sont suggestifs de la migration d'un corps étranger. Un échec de traitement, une localisation dans le lobe gauche, une localisation unique, et l'absence des facteurs de risque habituels peuvent également faire évoquer le diagnostic, comme le montre la comparaison avec les séries cryptogénique d'abcès du foie.

Conclusion : l'abcès du foie par migration de corps étranger ingéré est une entité spécifique, de plus en plus souvent rapportée. La guérison du patient nécessite habituellement le diagnostic précis, mais un retard diagnostique est habituel. Notre étude fournit à ce jour ce que nous considérons comme la meilleure stratégie pour un diagnostic rapide et exact. Cette stratégie est applicable au niveau mondial mais comporte certaines limitations. De plus, une attention particulière est nécessaire pour diagnostiquer et traiter efficacement cette pathologie probablement sous-diagnostiquée.

Migrated Foreign Body Liver Abscess

Illustrative Case Report, Systematic Review, and Proposed Diagnostic Algorithm

Nicola Leggieri, MD, Pedro Marques-Vidal, MD, Herwig Cerwenka, MD, Alban Denys, MD, Gian Dorta, MD, Vincent Moutardier, MD, PhD, and Didier Raoult, MD, PhD

Abstract: Pyogenic liver abscess is a severe condition and a therapeutic challenge. Treatment failure may be due to an unrecognized ingested foreign body that migrated from the gastrointestinal tract. There has recently been a marked increase in the number of reported cases of this condition, but initial misdiagnosis as cryptogenic liver abscess still occurs in the majority of cases. We conducted the current study to characterize this entity and provide a diagnostic strategy applicable worldwide.

To this end, data were collected from our case and from a systematic review that identified 59 well-described cases. Another systematic review identified series of cryptogenic—and Asian *Klebsiella*—liver abscess; these data were pooled and compared with the data from the cases of migrated foreign body liver abscess.

The review points out the low diagnostic accuracy of history taking, modern imaging, and even surgical exploration. A fistula found through imaging procedures or endoscopy warrants surgical exploration. Findings suggestive of foreign body migration are symptoms of gastrointestinal perforation, computed tomography demonstration of a thickened gastrointestinal wall in continuity with the abscess, and adhesions seen during surgery. Treatment failure, left lobe location, unique location (that is, only 1 abscess location within the liver), and absence of underlying conditions also point to the diagnosis, as shown by comparison with the cryptogenic liver abscess series.

This study demonstrates that migrated foreign body liver abscess is a specific entity, increasingly reported. It usually is not cured when unrecognized, and diagnosis is mainly delayed. This study provides what we consider the best available evidence for timely diagnosis with worldwide applicability. Increased awareness is required to treat this underestimated condition effectively, and further studies are needed.

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Abbreviations: CT = computed tomography, FB = foreign body, MRI = magnetic resonance imaging, US = ultrasound imaging.

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INTRODUCTION

Pyogenic liver abscess remains a therapeutic challenge despite major advances in imaging and in treatment strategies.^{11,35,38,75} An ingested foreign body that perforated the gastrointestinal tract, migrated to the liver, and caused an abscess was first described by Lambert in 1898.⁴⁶ Since then, migrated foreign body has been increasingly recognized as a cause of liver abscess treatment failure^{10,12,13,19,23,32,36,43,45,48,57,59,60,62,64,68,72–74,76,80} that can be prevented by foreign body removal. Still, and despite complete history taking, physical examination, and the extensive use of modern radioimaging by computed tomography (CT) and ultrasound imaging (US) in recent reports,^{12,43,45,59,68,72–74} most cases of migrated foreign body liver abscesses are initially misdiagnosed as cryptogenic liver abscesses. More than a century after the first case was described, we present an illustrative case of liver abscess treatment failure due to unrecognized migrated foreign body, confirming that improved diagnostic methods are urgently needed.

We conducted the current study to examine in detail the clinical, anatomical, and microbiologic characteristics, along with the response to therapy, of migrated foreign body liver abscesses and to compare them with the main differential diagnosis: cryptogenic liver abscess and cryptogenic *Klebsiella* liver abscess in Eastern Asia.

ILLUSTRATIVE CASE REPORT

A 62-year-old white man was admitted to a local hospital. He complained of fever, chills, and intermittent diffuse abdominal pain. Palpation of his abdomen showed no abnormal findings. Laboratory investigations revealed mild leukocytosis (11.6 g/L; normal range, 4–10 g/L) and elevated C-reactive protein (17.4 mg/L; normal range, 0–0.5 mg/L). His CT scan yielded a 6-cm hypodense lesion in the liver segments 4b/5/8 (Couinaud classification). Because he had been traveling in Africa some months before, an amebic abscess was suspected and treatment with metronidazole was started. However, this strategy was not successful, and serologic testing for amebiasis, schistosomiasis, and echinococcosis was negative. Gastroscopy revealed no abnormal findings. The patient was thus transferred to a hepatobiliary center.

Apart from arterial hypertension and an episode of pancreatitis 1 year before, no underlying diseases (such as cancer, diabetes, or immunosuppression) were known. On CT scan and magnetic resonance imaging (MRI), no foreign body, fistula, or thickening of the gastrointestinal wall were detected. Intraoperatively, however, tight adhesions between the liver and the pyloric region were seen.

Intraoperative sonography showed a septate hypoechoic hepatic lesion with hyperechoic rim, ventral to the bifurcation of the portal vein, corresponding to the known abscess cavity. After dissection of the adhesions, an intact toothpick was found protruding about 4 cm into the abscess cavity. The corresponding

region in the prepyloric part of the stomach was fibrotic (about 8 mm thick) and was excised; the gastric mucosa was intact—obviously the perforation site had already healed.

The gastrotomy was closed by sutures; the abscess was completely evacuated and drained. Microscopy of abscess material (with gram stain) showed leukocytes and gram-positive cocci; culture yielded *Streptococcus constellatus*.

The antibiotic administered was amoxicillin and clavulanic acid according to the result of sensitivity testing. The patient's postoperative course was uneventful, and a follow-up CT scan after 3 months showed only some minor residual changes in the liver.

METHODS

Data Collection

We conducted a systematic MEDLINE (National Library of Medicine, Bethesda, MD) search of all papers published from 1966 (first available year) to 2007. We used the key words “liver abscess” or “hepatic abscess” on 1 side and “foreign body,” “toothpick,” “fishbone,” “chicken bone,” or “needle” on the other. No language limits were set. Secondary references were also reviewed. Papers were included if a liver abscess was described with an ingested foreign body within the abscess. The following variables were analyzed: presenting complaints; past medical history; physical examination; laboratory findings; findings from imaging studies, endoscopy, surgery, and autopsy; type and size of foreign body; microbiology; treatment performed; and outcome. If the report was of insufficient quality or with incomplete data, the case was excluded (Figure 1). Adhesion was defined as any degree of scar or inflammatory tissue between the liver and the gastrointestinal tract seen during surgery.

In order to compare migrated foreign body liver abscesses with cryptogenic liver abscesses, we performed a second systematic MEDLINE search using the key words “cryptogenic

liver abscess,” and data extraction was performed as described above. Case reports, pediatric series, and series with imprecise data (for example, US, CT, surgery, or autopsy not performed) were excluded (Figure 2).

Statistical Analysis

Comparisons between foreign body and cryptogenic abscesses were performed using Epi-Info (CDC, Atlanta, GA). We used the chi-square or the Fisher exact test for qualitative data analysis. Results are expressed as number of subjects and percentage, or as odds ratio and 95% confidence interval. Statistical significance was considered for $p < 0.05$.

RESULTS

Foreign Body Liver Abscesses

The initial literature review identified 74 papers, of which 55 were selected for analysis.^{1,3,4,8-10,12,13,15,17-19,22-27,29,31-34,36,37,39-43,45,46,48,51,52,57-62,64,67,68,71-74,76-80,84,85} The 55 selected papers represented 59 individual cases with liver abscess following intrahepatic migration of an ingested foreign body. Data from the reported case were added for a total of 60 cases. Of interest, 35 cases (58% of 60 cases) were reported in the last 10 years, showing a marked increase in the number of reported cases of this condition (Figure 3).

Medical History

Symptoms due to perforation or impaction are epigastric pain and upper gastrointestinal bleeding.⁷ Of the 60 patients, within the previous 3 months 2 (3%) patients had blood-streaked or coffee-ground vomiting and 11 (18%) complained of previous acute epigastralgia; 8 (13%) sought medical attention and 5 (8%) had further unsuccessful investigations. Overall, specific medical history was suggestive in only a limited number of cases (7/60; 12%).

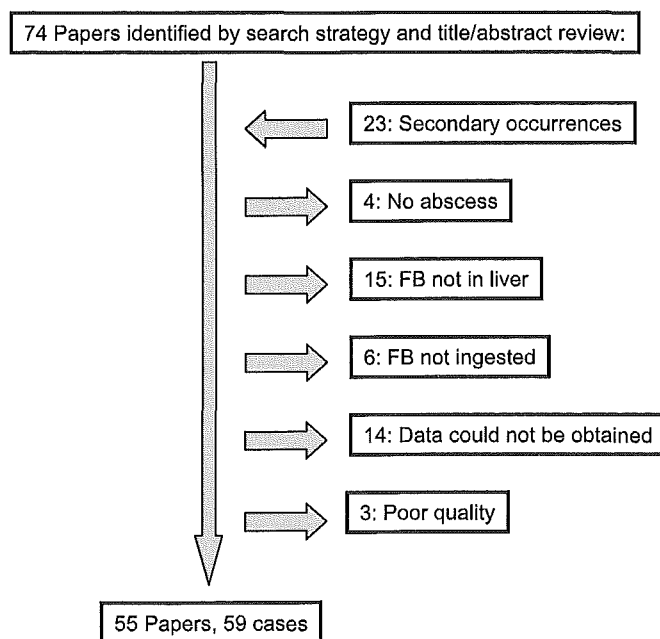


FIGURE 1. Flowchart: selection of articles on migrated foreign body liver abscess. Key: FB = foreign body. Arrows from left to right indicate excluded articles. “Secondary occurrences” are references of reviewed articles that were added to the original search results. “Data could not be obtained” means that our library was not able to provide the article and the author could not be contacted.

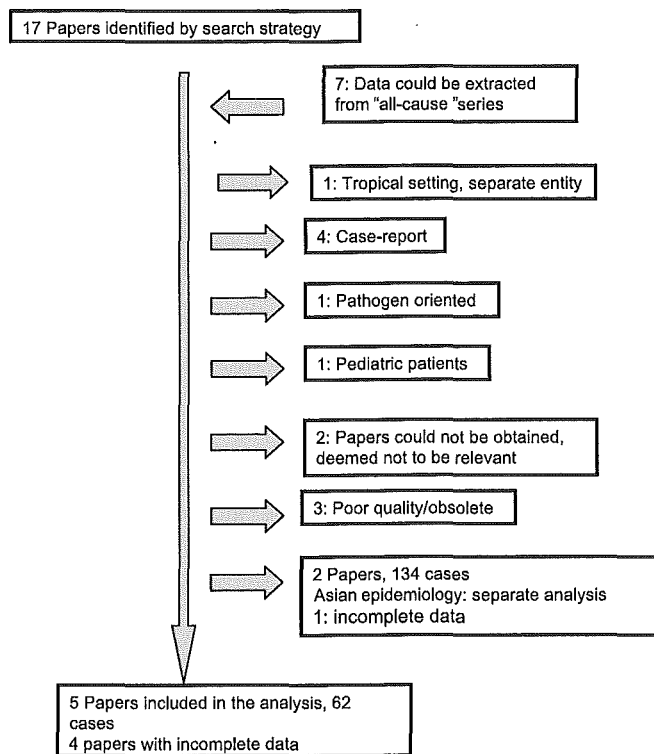


FIGURE 2. Flowchart: selection of series of cryptogenic liver abscess. Key: arrows from left to right indicate excluded articles; arrow from right to left indicate included articles. "Papers could not be obtained" means that our library was not able to provide the article and the author could not be contacted.

Systemic illnesses such as diabetes, cancer, cirrhosis, and immunosuppression are predisposing factors for liver abscess.^{38,55} Of the 60 patients, information regarding other illnesses was available in 49 (82%): 2 (3%) had diabetes and 1 (2%) was receiving steroids.

Only 3 patients (5%) mentioned foreign body ingestion, and 2 (3%) more had a clear recollection of the ingestion when asked about it. Predisposing factors for foreign body ingestion were severe psychiatric conditions in 3 (5%) cases, all of them with a past history of foreign body ingestion. Other known predisposing factors, such as alcohol abuse or being a prisoner,^{7,81} were present in fewer than 5% of the subjects. (Prisoners may voluntarily swallow foreign bodies as a way to be transferred

temporarily from jail to hospital. In one series,⁸¹ 70% of the patients were prison inmates.)

Patients and Clinical Presentation

Of the 60 patients, 41 (68%) were male and the age range at diagnosis was 14–86 years (mean, 54 yr). Epigastric or abdominal pain was the most common presenting symptom (51/60 cases; 85%), followed by general symptoms such as fever, chills, anorexia, weight loss, and fatigue (44/60 cases; 73%), while right upper quadrant pain was much less frequent (17/60; 28%). Duration of symptoms ranged from 1 day to 1 year (mean, 39 d).

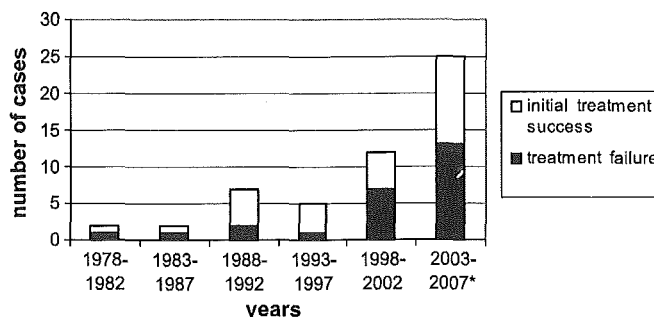


FIGURE 3. Reported cases by years. *One patient experienced 3 treatment failures. The reported case is included. Note: treatment failures before 1978 (that is, failures from 1898, 1925, 1935, 1940, 1955 [n = 2], 1961, and 1971 [n = 2]) are not shown.

TABLE 1. Comparison of Migrated Foreign Body Liver Abscesses and Western Series of Cryptogenic Liver Abscesses

	Left Lobe Location* No. (%)	Polymicrobial Infection† No. (%)	Unique Location‡ No. (%)	No Underlying Condition No. (%)	Treatment Failure§ No. (%)
Migrated foreign body (PR)	35/60 (58.3)	15/32 (46.9)	55/60 (91.7)	48/51 (94.1)	19/21 (90.4)
Western series (First author, reference, year)					
<i>Series with incomplete data</i>					
Lazarchick ⁴⁷ 1973	5/14 (35.7)		9/14 (64.3)		
Branum ¹¹ 1990			17/20 (85.0)	18/20 (90.0)	
Seeto ⁶⁹ 1996			36/57 (63.2)		
Barakate ⁶ 1999	7/37 (19.0)				
<i>Series with complete data</i>					
Ranson ⁶⁶ 1975	2/8 (25.0)	3/5 (60.0)	5/8 (62.5)	6/8 (75.0)	3/8 (37.5)
Mayberry ⁵³ 1987	3/12 (25.0)	1/8 (12.5)	8/12 (66.7)	11/12 (91.7)	3/12 (25.0)
Minuk ⁵⁴ 1987	2/5 (40.0)	0/3 (0.0)	3/5 (60.0)	5/5 (100.0)	0/5 (0.0)
Klatchko ⁴⁴ 1989	0/3 (0.0)	1/3 (33.3)	2/3 (66.7)	2/3 (66.7)	0/3 (0.0)
Alvarez Perez ² 2001	9/34 (26.5)	6/21 (28.6)	27/34 (79.4)	22/34 (64.7)	7/34 (20.6)
All Western series with complete data (pooled)	16/62 (25.8)	11/40 (27.5)	45/62 (72.6)	46/62 (74.2)	13/62 (21.0)
Test¶	Chi-square	Chi-square	Chi-square	Chi-square	Chi-square
P-value	<0.001	0.09	<0.006	<0.005	<0.001
OR [95% CI]	4.03 [1.75–9.34]	2.33 [0.78–6.98]	4.16 [1.32–15.4]	5.57 [1.44–31.3]	35.8 [6.86–336.0]

Abbreviations: PR = present report, OR = odds ratio, CI = confidence interval.

*Left lobe involvement was considered in the absence of any other involvement.

†The infection was considered polymicrobial when cultures grew 2 or more microorganisms.

‡Unique: only 1 abscess location within the liver.

§Treatment failure was considered whatever the procedure had been: antibiotics, percutaneous drainage, or surgical drainage.

||Series of cryptogenic liver abscesses.

¶Comparing data from series of migrated foreign body liver abscess with pooled data from all Western series of cryptogenic liver abscess having complete data.

Physical examination was rarely completely normal (2/60; 3%). Fever was the most common finding (43/51; 84%) followed by general abdominal or epigastric pain (28/60; 47%). Conversely, more specific signs like right upper quadrant pain (23/60; 38%), liver enlargement (5/60; 8%), septic shock (5/60; 8%), and jaundice (3/59; 5%) were less common.

Laboratory Findings

Inflammatory markers such as leukocytosis (>10.5 G/L) or left shift were observed in most cases (34/43; 79%). When assessed, C-reactive protein and sedimentation rate were elevated in all cases. Finally, slightly more than half of the cases (32/60; 53%) reported blood and/or abscess cultures (Table 1).

Radiology, Surgery, Endoscopy, and Autopsy Findings

Figure 4 summarizes the diagnostic procedures for all cases with US or CT imaging. Diagnosis of foreign body migration was achieved by eso-gastro-duodenoscopy in 3/19 (16%) of the cases, US (confirmatory or intraoperative excluded) in 9/33 (27%), and CT in 18/35 (51%).

CT was performed with contrast in 27/35 (77%); this information is lacking in the other cases. The imaging was focused on the liver in 10/35 (28%) cases, while it was part of a wider exploration or unspecified in other cases. One or more abscess was seen in 34/35 (97%) cases, whereas the abscess was not

noticed in 1 case. The offending foreign body was seen on 2 CT scans, but was misinterpreted as a "surgical clip" or "artifact."

Magnetic resonance imaging was used in 5 cases; it did not enable diagnosis in any case. A liver abscess was visualized in 4/5 (80%) cases.

Exploratory laparoscopy or laparotomy (in first intention or after failure) led to the correct diagnosis in 19/25 (76%) cases. In all cases, the foreign body was first detected by the surgeon during intervention; the diagnosis was never achieved by "blind" hepatectomy with fortuitous discovery of the foreign body during resected piece dissection. Finally, all 10 autopsies performed led to the correct diagnosis.

Findings Other Than Foreign Body

Most anatomical findings are summarized in Figures 5 and 6, along with migrations of foreign body. Sufficient details were reported in 56/60 (93%) reports; adhesions were found in 50 of those 56 (89%) cases.

Of the 40 cases with CT or US performed, only 1 (3%) enabled direct visualization of a fistulous tract,¹² and a thickened gastrointestinal wall in contact with the liver abscess was seen in 6 (15%) cases.

Of the 20 endoscopies performed, some degree of dimpling or mucosal inflammation was mentioned in 5 (25%) cases, an ulcer/erosion with an extrinsic compression caused by the abscess was noted in 3 (15%), a fistula with pus was noted in 3 (15%)

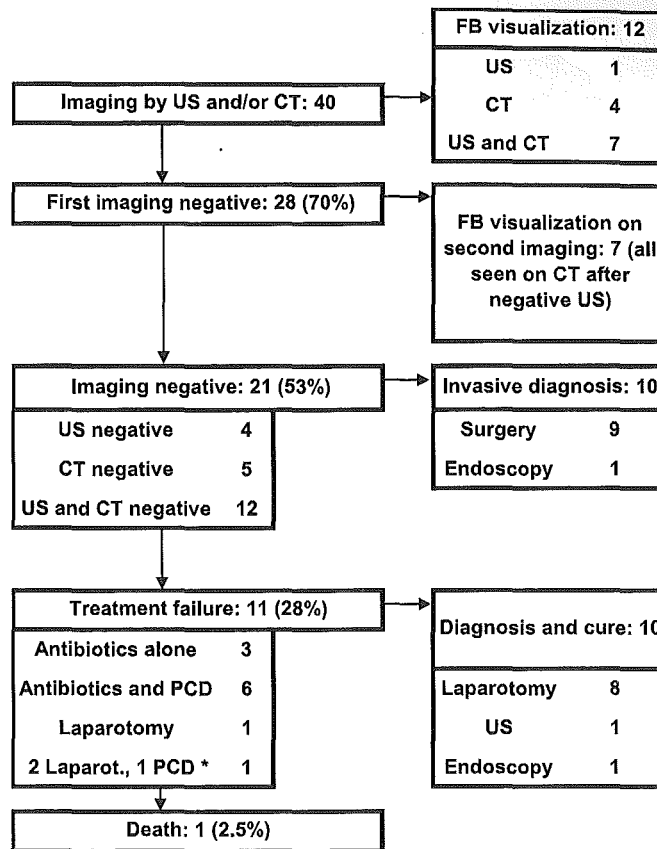


FIGURE 4. Diagnostic imaging studies. *Despite repeated modern imaging. Abbreviations: FB = foreign body, CT = computed tomography, US = ultrasound, PCD = percutaneous drainage.

cases, and the foreign body was seen in 3 (15%) cases. Conversely, the examination was reported as normal in 6 (30%) cases.

Route of Infection

All authors presented the abscess as secondary to the foreign body migration. Only 1 report mentioned calcu-

lus cholecystitis,⁴² but it was ruled out as the cause of the abscess.

Nature of the Foreign Body

Foreign bodies were identified in 59/60 cases, and were removed in 47/50 cases (autopsies excluded). A single foreign

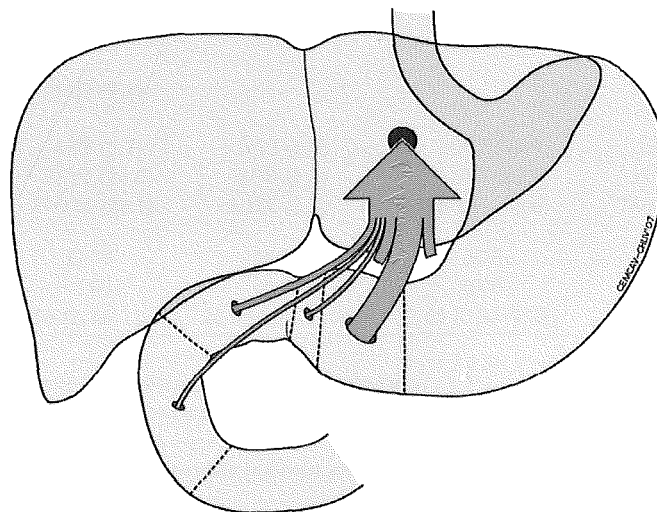


FIGURE 5. Perforation sites in left-lobe liver abscess. Key: areas delimited by dotted lines are, from right to left: second part of duodenum, first part of duodenum, pylorus, antrum. Interrupted arrows were drawn for imprecise perforation points.

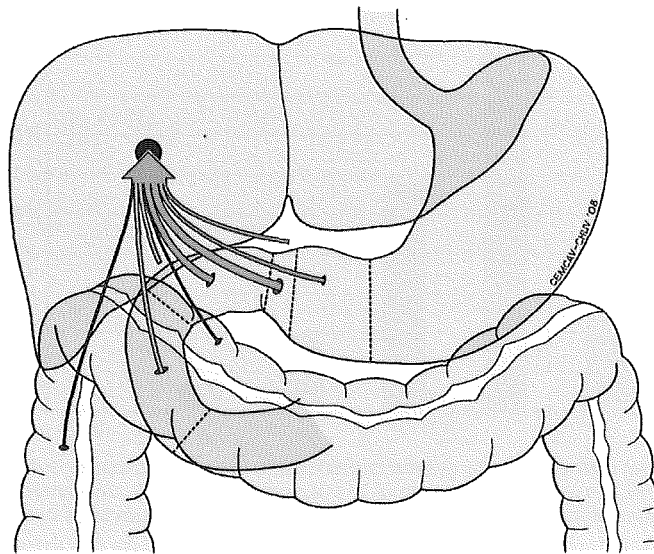


FIGURE 6. Perforation sites in right-lobe liver abscess. Key: areas delimited by dotted lines are, from right to left: second part of duodenum, first part of duodenum, pylorus, antrum. Perforation sites in the colon are, from right to left: ascending colon and transverse colon. Interrupted arrows were drawn for imprecise perforation points.

body was seen in 57 cases, 2 patients had multiple foreign bodies, and no foreign body was found in 1 case, with just the fistula remaining. The most common foreign bodies were fish bone (26/59; 44%), toothpick (17/59; 29%), and chicken bone (5/59; 8%). Metallic foreign bodies were less frequent: needle (4/59; 7%), clothespin (2/59; 3%), pen (1/59; 2%), and wire (1/59;

2%). Unidentified bone was found in 3/59 (5%). The size of the foreign body varied between 1 and 10 cm (mean, 4 cm).

Treatment and Outcome

The 19 attempts of treatment in the absence of a correct diagnosis failed regardless of the procedure: 9 with antibiotics

TABLE 2. Comparison of Migrated Foreign Body Liver Abscesses and Asian Series of Cryptogenic Liver Abscesses

	Left Lobe Location* No. (%)	Polymicrobial Infection† No. (%)	Unique Location‡ No. (%)	No Underlying Condition No. (%)	Treatment Failure§ No. (%)
Migrated foreign body (PR)	35/60 (58.3)	15/32 (46.9)	55/60 (91.7)	48/51 (94.1)	19/21 (90.4)
Asian series (First author, reference, year)					
<i>Series with incomplete data</i>					
Chu ²¹ 1996	3/37 (8.1)			30/37 (81.1)	
<i>Series with complete data</i>					
Chen ¹⁶ 2005	4/52 (7.7)	3/52 (5.8)	40/52 (76.9)	20/52 (38.5)	5/52 (9.6)
Choi ²⁰ 2007	23/82 (28.0)	1/70 (1.4)	68/82 (82.9)	58/82 (70.7)	3/82 (3.7)
All Asian series with complete data (pooled)	27/134 (20.1)	4/122 (3.3)	108/134 (80.6)	78/134 (58.2)	8/134 (6.0)
Test¶	27.79	Fisher	3.78	21.93	Fisher
P-value	<0.001	<0.001	0.06	<0.001	<0.001
OR [95% CI]	5.55 [2.71–11.4]	26.0 [6.97–116.3]	2.65 [0.93–9.28]	11.5 [3.39–59.9]	149.6 [26.6–1411.0]

Abbreviations: See Table 1.

*Left lobe involvement was considered in the absence of any other involvement.

†The infection was considered polymicrobial when cultures grew 2 or more microorganisms.

‡Unique: only 1 abscess location within the liver.

§Treatment failure was considered whatever the procedure had been: antibiotics, percutaneous drainage, or surgical drainage.

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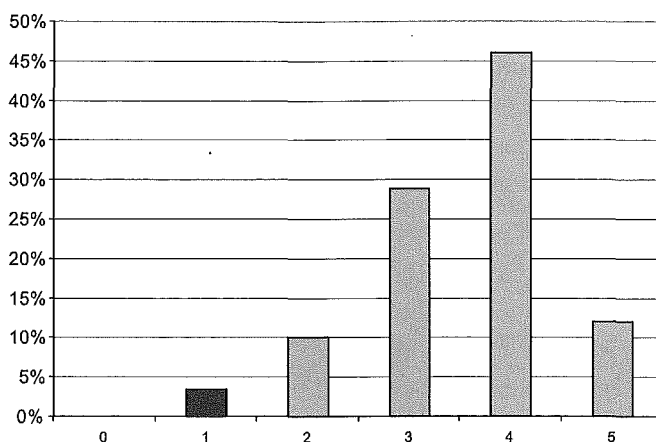


FIGURE 7. Migrated foreign body liver abscess: number of characteristics among 60 patients with foreign body liver abscess. Characteristics include perforation symptoms, CT findings suggestive of foreign body liver abscess, left lobe location, unique location, absence of underlying conditions, and adhesions on surgery. The black bar represents cases undetected by the diagnostic algorithm proposed in Figure 8.

alone, 8 with antibiotics and percutaneous drainage, and 2 with antibiotics and surgical drainage. Conversely, once the diagnosis of foreign body was correctly established, all but 1 patient (who died despite foreign body removal in 1925⁸⁴) achieved cure.

Successful treatments included laparotomy in 40 cases: surgical drainage in 27, hepatectomy (including 1 left lobectomy) in 7, drainage and perforation repair in 4, and drainage and partial gastrectomy in 2 cases. Other successful treatments included removal by gastroduodenoscopy in 5 cases and laparoscopic removal in 2 cases. The foreign body was not removed in 2 cases: the patients were cured by antibiotics and percutaneous drainage,⁸⁵ or antibiotics alone.¹⁸ Among the 21 patients in whom treatment was first attempted without foreign body removal, the success rate was 2/21 (9.5%).

Cryptogenic Abscesses

Results are summarized in Table 1. Western series reviewed included a Spanish multicenter series from 1985 to 1997,² 2 United States single-center series from 1971 to 1974⁶⁶ and 1979 to 1985,⁴⁴ a United Kingdom single-center series from 1977 to 1985,⁵³ and a Canadian 2-center series from 1978 to 1983.⁵⁴ Series with incomplete data from the United States^{11,47,69} and Australia⁶ were reviewed, but those data were not included in the analysis.

Eastern Asian series with high rate of *Klebsiella* were included in the review (Table 2): a Taiwanese single-center series from 1996 to 2003 with 88% *Klebsiella*,¹⁶ and a Korean single-center series from 2000 to 2004 with 44% *Klebsiella*.²⁰ A series with incomplete data from Hong Kong²¹ was reviewed, but the data were not included in the analysis.

Comparison of Foreign Body Abscesses and Cryptogenic Abscesses

Results of the comparison are shown in Tables 1 and 2. When data were lacking, the item in question was considered to be negative. In case of unclear events, we chose the least favorable possibility for the comparison.

All cases of foreign body liver abscess were reviewed for the following characteristics: perforation symptoms, CT findings suggestive of foreign body liver abscess, left lobe location, absence of underlying conditions, unique location (that is, only

1 location within the liver), and adhesions on surgery. No case had 0 characteristics, 2/60 (3%) had only 1 characteristic, while 10% (6/60) had 2, 30% (18/60) had 3, 45% (27/60) had 4, and 12% (7/60) had 5 characteristics (Figure 7). This information was used to derive the diagnostic algorithm described below. When data were lacking, the item in question was considered to be negative.

DISCUSSION

To our knowledge, the current study is the first comprehensive review of liver abscesses due to migration of ingested foreign bodies. We emphasize here the poor diagnostic accuracy of this emerging condition.

A sharp increase in the number of reported cases has been seen in the last 15 years (see Figure 3). The use of toothpicks has been reported since antiquity,⁵ and consumption of fish and chicken, with the risk of ingesting a bone, certainly predates the toothpick. We therefore suggest that the rise is mainly due to an increase in diagnosis rate or in reporting efforts, with the incidence being relatively stable. The proportion is probably higher than expected: as an example, Cerwenka found 1 case out of 76 cases of liver abscess from all causes.¹⁴ It seems clear that the condition deserves specific attention, especially since about half of the patients experience treatment failure (including death), without observed improvement.

As seen in the Treatment and Outcome section above, the diagnosis of migrated foreign body is a prerequisite condition to the cure, generally obtained by foreign body removal. Therefore, we review diagnostic means and clues specifically below.

Medical History and Clinical Presentation

History of negative investigations for epigastralgia or history of blood-streaked vomiting within the previous 3 months before diagnosis of a liver abscess can be considered suggestive of perforation symptoms, although not completely specific (see diagnostic algorithm below).

Among the elements that should prompt the diagnosis, history of foreign body ingestion was found in only 3 (5%) of the cases in the present series, and recollection of ingestion in 2 more. Two series of foreign body ingestion^{28,63} found similarly

low rates of contributive history. It is noteworthy that all 3 psychiatric patients in the review had a past history of foreign body ingestion; this must be particularly sought in that population. History taking may prompt diagnosis, but in only a few patients. Moreover, a foreign body may cause a liver abscess by impaction in the mucosa,⁷⁰ which must be searched for by CT and endoscopies.

Few demographic data are available for the comparative study: we found data in 3 of 9 Western studies and 1 of 3 Eastern Asian series. Mean age is 54 years in Western studies, with 57% male patients; and 58 years, with 65% male patients in Asian series. All statistical comparisons with the current series of migrated foreign body liver abscess were nonsignificant. The classical presentation of fever with jaundice and right upper quadrant pain is seldom seen, as in the largest series.⁶⁹

Diagnosis by Radiology, Surgery, and Endoscopy Findings

We found that CT performed better than US in identifying the offending foreign body (55% vs. 27%), but the accuracy is still low (see Figure 4). Goh et al,²⁸ in a series of 62 cases of foreign body gastrointestinal perforation, reported comparable CT accuracy (58%), while Li and Ender,⁴⁹ in a systematic review of 57 toothpick-related internal injuries, found an even lower accuracy for CT (15% for CT and 29% for US). Overall, those findings suggest that relying only on imaging techniques for diagnosis is not adequate. Even exploratory laparotomy, with a sensitivity of 75%, cannot be used to rule out the diagnosis. Furthermore, underdiagnosis and unrecognized mortality are major concerns: among the 10 autopsies, 1 (10%) investigated the fatal outcome of known liver abscess, the others were investigations of sepsis of unknown origin. It is probable and most worrisome that migrated foreign body liver abscess is not considered in the differential diagnosis of cryptogenic liver abscess and not searched for even in case of treatment failure. Hence, new diagnostic strategies are needed.

Since CT performs better than US for foreign body visualization, it must be performed in all cryptogenic liver abscesses, and a foreign body must be specifically searched for. On the other hand, if another cause is found on CT, foreign body liver abscess can be reasonably excluded.

Because of the lack of experience with MRI and the apparent low accuracy, we do not consider it a useful diagnostic tool at this time.

Foreign body within an abscess can be seen in other etiologies: posttraumatic, postsurgery, following foreign body abdominal migration after rectal perforation,⁸³ or due to intrahepatic lithiasis,²¹ but these conditions can be readily diagnosed by history taking and imaging.

Visualization of a fistulous tract by CT or US¹² warrants surgical exploration, after exclusion of other causes. Spontaneous fistulization is possible, but it tends to have a very favorable evolution.⁵⁶ A fistula may result from a gastric ulcer, but stomach pneumatosis, extravasated ingested contrast medium, and direct visualization of the ulcer by gastroscopy^{55,82} help to diagnose this condition readily. Fascioliasis may produce subcapsular lesions with tortuous tracts within the hepatic parenchyma,³⁰ but the multiple lesions, the eosinophilia, and the epidemiology point to the diagnosis in that case.

We consider that a thickened gastrointestinal wall in contact with a liver abscess is most probably a consequence of foreign body migration, as outlined by Drnovsek et al,²⁵ and is therefore a suggestive finding, as seen on 6/35 CT (17%) scans. This finding is not completely specific since, in our experience, an abscess reaching the capsula may rarely produce gastrointes-

tinal tract thickening and even fistula.⁵⁶ In surgery, adhesions between the perforated viscera and the hepatic capsula may also point to a foreign body migration. This is very often seen (89% of well-reported cases), but not completely specific (see above).

Endoscopic visualization of a fistula with pus warrants surgical exploration. This was seen in 3 cases (15% of 20 endoscopies). An ulcer/erosion with an extrinsic compression caused by an abscess was found in 15% (3/20). It is suggestive of a foreign body perforation, although not completely specific.

As seen in the section above on Route of Infection, all of the cases were "cryptogenic" before a diagnosis of migrated foreign body liver abscess was made. We therefore compared cases of migrated foreign body liver abscess with series of cryptogenic liver abscesses (see Table 1). Series from the United Kingdom, Spain, the United States, Canada, and Australia showed comparable results and were then pooled.

Comparison of Foreign Body Abscesses and Cryptogenic Abscesses

A significant difference is demonstrated for left lobe location, absence of underlying condition, and very strongly for treatment failure. Left lobe predominance in migrated foreign body liver abscess is well explained by anatomical relationships (see Figures 5 and 6). A liver abscess grows around the foreign body, which accounts for the unique location. Although multiple abscesses were rare in live patients (2/48; 4%), they were found in 3 of 10 autopsies ($p < 0.05$). This suggests that abscess dissemination is a terminal event, and we therefore consider that single location is relevant at the time of diagnosis even if it did only approach statistical significance when compared with Asian series. The mechanism of inoculation combined with a foreign body explains that predisposing conditions are usually absent in migrated foreign body liver abscess. Relapse of infection or progression despite adequate treatment is a well-known characteristic of foreign body infection.

Because of the design of our data comparison from systematic review, control for bias is not feasible (as in other reference papers⁶⁵). Still, comparisons with series of both cryptogenic abscesses and abscesses from *Klebsiella* in Asia are statistically significant, and suspected underlying mechanisms are very plausible. The current study therefore provides what we consider the best available evidence for diagnosis with worldwide applicability.

Polymicrobial infection only approaches statistical significance, and as the rate notoriously depends on culture techniques, we do not consider it helpful to make a diagnosis.

Diagnostic Algorithm

Left lobe location of the abscess, unique location, absence of underlying conditions, treatment failure, indirect evidence of foreign body migration on CT, and adhesion between liver and gastrointestinal tract in surgery are valuable findings for the diagnosis of a foreign body liver abscess. Indeed, most patients showed at least 2 of these characteristics (see Figure 7). (Because 1 of the 2 patients with only 1 characteristic was described in 1898,⁴⁶ much information on that patient was unavailable.) Thus, we consider foreign body liver abscess very unlikely in a patient without any of these characteristics. Presentation with a single characteristic is atypical; we do not recommend an aggressive approach in that case unless warranted by other considerations (see Figure 8).

Percutaneous drainage (by needle puncture or catheter) is now a widely used treatment method, in some centers even for multilocated or >5-cm liver abscesses, with good results.⁵⁰ An attempt at percutaneous drainage can fail because of technical

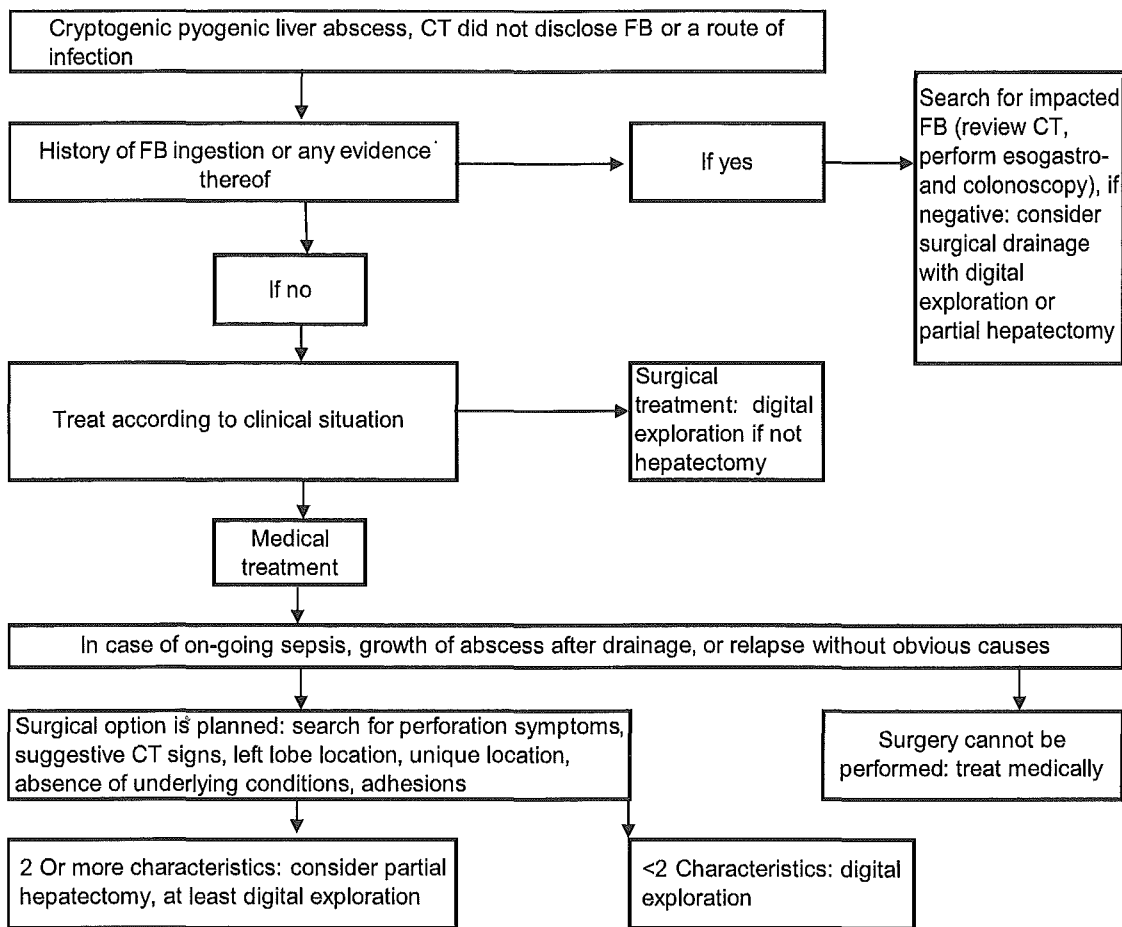


FIGURE 8. Diagnostic algorithm. Abbreviations: FB = foreign body, CT = computed tomography, US = ultrasound.

problems that prevent satisfactory emptying of the abscess, such as misplacement or dislodgement of the catheter, or hyperviscosity of the pus. In these instances, the treatment failure should not be interpreted as a sign that a migrated foreign body is causing the abscess until a technically correct attempt has also failed. In case of treatment failure because of inadequate antibiotic treatment (whether the drainage was surgical or not), the same consideration applies, but this should not delay adequate drainage.

After treatment failure, foreign body migration should be considered when at least 2 characteristics of foreign body migration are present (see Figure 7). In this case, digital exploration should be performed during surgical drainage, although it enabled the diagnosis in only 76% of cases. Hope et al³⁵ demonstrated the safety of partial liver resection instead of surgical drainage for liver abscess. This approach, although surgically more complex, is to be considered in these selected patients, as it would allow removal of an undetected foreign body. Furthermore, since patients with diabetes, cancer, cirrhosis, or immunosuppression are less likely to be selected, eligible patients probably have lower surgical risk. Appropriate endoscopies (for example, eso-gastro-duodenoscopy for left-sided abscess, in addition to colonoscopy for right-sided lobe) may also point to the diagnosis.

We therefore propose the diagnostic algorithm presented in Figure 8.

Conclusion

Migrated foreign body liver abscess is a specific entity and an increasingly recognized cause of treatment failure in liver abscess. Delayed diagnosis is a major concern, despite extensive workup. The first step toward the correct diagnosis is increased awareness. Specific history taking about foreign body ingestion or perforation symptoms, as well as scrupulous CT review, may lead to the diagnosis. Diagnostic workup for foreign body migration should therefore parallel management for liver abscess, and digital exploration should be performed during surgical drainage. Treatment failure must prompt reassessment, and partial liver resection should be considered in selected cases. The current study provides what we consider the best available evidence for timely diagnosis of migrated foreign body liver abscess, including in Eastern Asia.

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