Original Article

Clinical features and computed tomography (CT) findings in abdominal actinomycosis: A retrospective review

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Abstract

Background: Actinomycosis is a rare chronic disease that presents diagnostic challenges owing to its similarity to malignancies and other infections. An early diagnosis and an appropriate antibiotic therapy are crucial for effective treatment. Surgical intervention may be necessary to manage abscesses or remove infected tissues.

Objective: To study the characteristics observed in computed tomography (CT) scans and key symptoms presentation to aid in the diagnosis of abdominal actinomycosis. This aims to contribute to more precise decision-making in selecting appropriate and beneficial treatment approaches for patients.

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Materials and Methods: A retrospective analysis of abdominopelvic actinomycosis cases (n=13) treated at Siriraj Hospital from January 2007 to June 2022 was conducted. Medical records, including clinical, pathological, microbiological, and therapeutic data, were analyzed comprehensively. The subjects underwent independent CT image interpretation by two experienced radiologists.

Results: CT findings, with abscess formation being predominant (n=8, 61.5%). Other findings included fistula tract formation (n=3, 23%), soft tissue mass mimicry (n=2, 15.3%), and presence of foreign bodies (n=4, 30.7%). The chief complaints prompting hospital visits included a palpable mass, abdominal pain, lower gastrointestinal tract bleeding, chronic diarrhea, and frequent urination.

Conclusion: Abdominal actinomycosis warrants consideration in the differential diagnosis of abdominal CT-detected masses and abscesses. Knowledge of CT features in actinomycosis infection, fistula formation, and retained foreign bodies in the lesion helps radiologists consider this infection in differential diagnosis and guides proper treatment planning.

Keywords: Abdominal actinomycosis, CT findings.

Introduction

Actinomycosis refers to a rare chronic disease caused by Actinomyces spp. Which are gram-positive filamentous non-acid fast anaerobic bacteria. These bacteria are typically part of the body's normal flora in regions such as the oral cavity, nasal cavity, intestines, and the genital tract They remain nonpathogenic [1, 2] unless infiltration into mucosal barrier and may result in a chronic infection characterized by proliferative tissue growth and abscess formation which can create a fistula tract to adjacent organs. Furthermore, there is a potential for extension into adjacent tissues, exhibiting characteristics resembling neoplastic masses or tumors, as evidenced by radiological imaging (tumor mimic) [1-3]. Additionally, hematogenous spread can lead to infections in distant areas, such as the lungs or liver. The most common etiologic organism of actinomycosis is Actinomyces israelii [1].

The primary objective was to study the characteristics observed on computed tomography (CT) scans and the key symptoms presented by patients upon hospital admission to aid in the accurate diagnosis of abdominal actinomycosis. This aim to increase awareness of this condition is essential for selecting appropriate and effective treatment strategies for patients.

Materials and methods

Patients

A retrospective analysis was performed on patients diagnosed with abdominopelvic actinomycosis who underwent surgical interventions between January 2007 to June 2022. Over this period included 13 cases that followed the research protocol and had completed the CT image and pathology result, comprising 4 males and 9 females. A thorough analysis of the medical records encompassed clinical, pathological, microbiological, and therapeutic data. This study was approved by the Siriraj Hospital board.

The inclusion criteria were as follows: 1. Patients were diagnosed with abdominal actinomycosis (abdominal organs, abdominal cavity or abdominal wall) at Siriraj Hospital 2. Patients aged ≥ 18 years.

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Exclusion Criteria are 1. Patients without radiological imaging data in the PACS system at Siriraj Hospital. 2. The presence of abdominal actinomycosis was confirmed in patients without pathological or laboratory test results. 3. The time interval between the CT scan and tissue diagnosis of abdominal actinomycosis was more than 1 month.

Image interpretation

The CT images were retrospectively reviewed by two experienced body imaging radiologists. Radiological features analyzed included location, lesion size, heterogeneity of the lesion, border characteristics (smooth or irregular), enhancement pattern, abscess formation, fistula formation, or foreign body detection, extent and spread of lesions into adjacent tissues, quantification of white blood cells from blood test results, and surgical or treatment procedures undertaken to obtain the tissue specimen.

Results

The research gathered 22 patients diagnosed with abdominopelvic actinomycosis and excluded 9 patients who did not have pre-operative imaging in the PACS system. The study cohort of 13 patients with abdominopelvic actinomycosis, of which 4 were male and 9 were female (mean age, 52.3 year; range, 29-76 years.). The chief complaints initiating a visit to the hospital were palpable mass (n=3, 23.07%), flank pain (n=2, 15.38%), right upper quadrant pain (n=2, 15.38%), pelvic pain (n=2, 15.38%), lower gastrointestinal tract bleeding (n=2, 15.38%), chronic diarrhea (n=1, 7.69%) and frequent urination (n=1, 7.69%). The duration from development of symptoms to a hospital visit ranged from 1 week to 52 weeks, with an average of 11.92 ± 14.64 weeks (Table 1).

Table 1. *Demography and clinical characteristics of patients.*

	Age	Sex	Predisposing Factors	Presentation	Initial diagnosis	WBC (μL)	CT finding	Surgery/treatment	Duration of symptom (week)	Length of stays (day)
1	54	F	-	Right lower quadrant pain Palpable mass	Retroperitoneal mass (soft tissue sarcoma)	6590	- Retroperitoneal abscess and psoas muscle abscess	CT-guided percutaneous tissue biopsy Wide excision	32	6
2	76	F	Hypertension, intrahepatic duct stone	Right upper quadrant pain	Intrahepatic duct stone with left lobe atrophy	5700	- Intrahepatic duct stone with chronic cholangitis - left portal vein thrombosis	Left lateral segmentectomy	24	5
3	60	M	Diabetes Mellitus	Back pain Fever, Palpable mass	Emphysematous pyelonephritis	34960	- Emphysematous pyelonephritis with perinephric abscess involved psoas muscle, posterior pararenal space and posterior abdominal wall, multiple renal stone	Open drainage, left radical nephrec-tomy	2	36
4	29	F	Ulcerative colitis on steroid	Lower gastrointestinal bleeding, Chronic diarrhea	Ulcerative colitis	8900	- Diffuse colonic wall thickening with s ubmucosal deep ulcer	Total colectomy	52	12
5	60	F	-	Abdominal mass	TB ileum	11110	- Matted small bowel appearance at terminal ileum and IC valve	Ileocecal resection	2	10
6	58	F	Intrauterine device used	Pelvic pain, Vaginal bleeding	CA cervix	15510	- Left adnexal abscess with fistula tract to sigmoid colon	TAH with BSO with partial excision mass at cu de sac	8	7
7	75	F	Type2 Diabetes Mellitus, Hypertension	Frequent urination	Pelvic abscess	9800	- Pelvic abscess involve bladder and uterus with fistula tract to sigmoid colon	Sigmoidectomy	4	36
8	31	F	Endometriosis	Pelvic pain	Ovarian abscess	13850	Tubo-ovarian abscess	Excision	4	3
9	41	F	-	Abdominal wall mass	Abdominal wall mass	7870	Abdominal wall mass	Excision	2	2
10	48	F	Intrauterine device used	Pelvic pain	Left psoas abscess	12940	- Pelvic abscess involved psoas and iliopsoas muscle - fistula tract to p osterior abdominal wall	Percutaneous drainage	12	15
11	47	M	Congenital single left kidney	Left flank pain, Fever	Left renal mass	25300	- Multiloculated small abscess at left kidney extended involve adrenal gland, spleen, abdominal wall, pleural cavity.	Ultrasound guided biopsy	8	1
12	32	M	-	Lower gas-trointestinal bleeding	Appendiceal tumor and appendicitis	8000	Chronic appendicitis	Right hemicolectomy	1	6
13	69	M	Type2 Diabe-tes Mellitus	Right upper quadrant pain	Liver mass	10280	Liver abscess	Ultrasound guided biopsy and debridement	4	6

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The result of laboratory test and pre-operative diagnosis according to blood chemistry tests, the mean numbers of WBC averaged 13,139.23/μL, which were slightly higher than normal (normal value; 4,000-10,000 /μL). An abdominal CT scan was performed on all patients, which detected either an intra-abdominal mass or abscess, and mimicking malignancy. Locations of the lesion were pelvic cavity (n =3), retroperitoneal space (n = 2), kidney (n = 2), liver (n =2), appendix (n =1), abdominal wall (n =1), colon (n = 1) and small bowel (n =1).

CT findings in the presented cases were predominantly centered on the formation of rim-enhancing abscesses, indicative of an ongoing infection and inflammatory process. Abscess formation being the most common, observed in 61.5% of cases (n=8). CT demonstrates an abnormally low attenuation area with surrounding rim enhancement, which might be an irregular, thick, or soft tissue mimic, mostly extending extensively into adjacent tissues.

Additionally, fistula tract formation was identified in 23% of the cases (n=3), underscoring the complex nature of actinomycosis-associated pathology. This presents as an abnormal connection between a complex abscess and adjacent organs or the skin, sometimes showing enhancement along the fistula tract.

Notably, only soft tissue mass presentation mimicry was noted in 15.3% of cases (n=2, in the liver and kidney), and actinomycosis infection was not included in the initial diagnosis owing to clinical features, complexity of the infection, soft tissue density mimic, and association with enhanced inflamed soft tissue. In addition, a small fistula tract may not be recognized. This was interpreted as a malignant tumor.

Furthermore, the foreign body related pattern, the presence of intrauterine device used in 2 cases (15.3%), renal stones in 1 case (7.6%) and intrahepatic duct stone in 1 case (7.6%) were notable. (Table 2). Pelvic abscesses were the most commonly observed manifestations. One notable case featured a left adnexal thick-wall abscess with a fistula tract extending to the sigmoid colon, with a noteworthy history of 30 years of intrauterine device use (Figure 1). Another case was a multiloculated irregular abscess involving the left pelvic cavity, psoas muscle, and iliopsoas with a fistula tract from the psoas muscle to the posterior abdominal wall with a history of 12 years of intrauterine device use (Figure 2).

Table 2. *The key CT findings in the study.*

CT Findings	Number of patients
Complex abscess formation	8 (61.5%)
Fistula tract	3 (23%)
Mass forming	2 (15.3%)
Intrauterine device used	2 (15.3%)
Renal stones	1 (7.6%)
Intrahepatic duct stones	1 (7.6%)

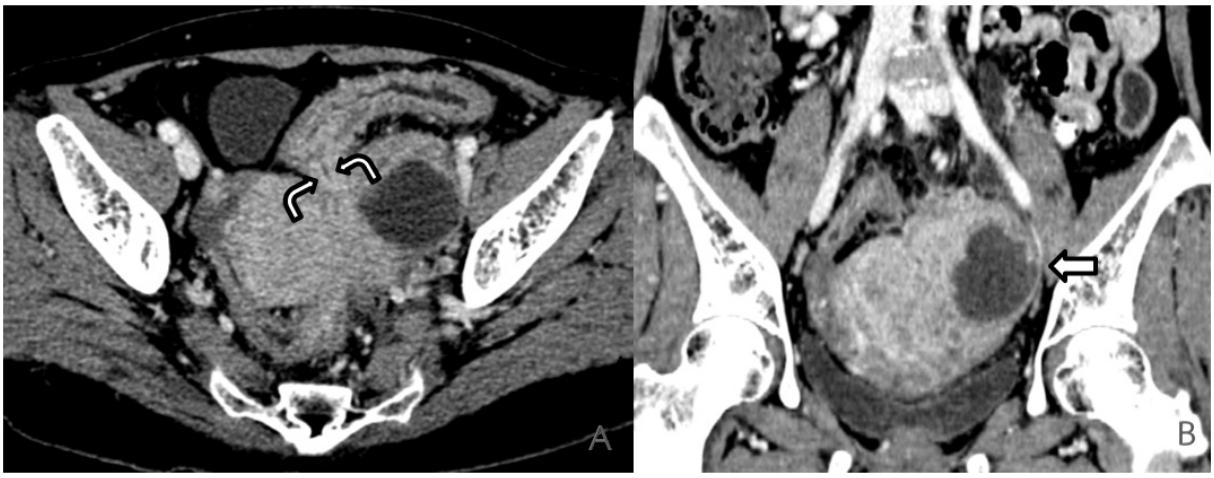

Figure 1. *A 58-year-old female presented with pelvic pain and history of 30 years of intrauterine device. CT scan portovenous phase A) axial plane and B) coronal plane demonstrated the irregular wall abscess at left adnexa (arrow) or ovarian abscess with fistulous tract (curve arrow) to sigmoid colon and bowel wall thickening.*

Figure 2. *A 48-year-old female presented with pelvic pain and history of 12 years of intrauterine device. CT scan portovenous phase A) coronal and B) axial plane demonstrated the irregular multiloculated abscess involved left adnexa (curve arrow), psoas muscle and iliopsoas with fistula tract from psoas muscle to posterior abdominal wall. Intrauterine device placed in the endometrial cavity (arrow).*

In two cases of renal actinomycosis, one had an underlying congenital single left kidney and presented with left flank pain and fever. Further CT showed multiple tiny rim-enhancing cystic lesions, probably representing chronic focal pyelonephritis or inflammatory pseudotumor and extended involvement of the left adrenal gland, spleen, and abdominal wall, and the differential diagnosis included renal cancer (Figure 3). Biopsies were performed to provide conclusive evidence of actinomycotic infection. Another patient presented with severe back pain, fever, and palpable mass. CT tomography revealed emphysematous pyelonephritis with perinephric abscess involving psoas muscle extension to the posterior pararenal space and posterior abdominal wall with multiple associated renal stones in the left kidney (Figure 4).

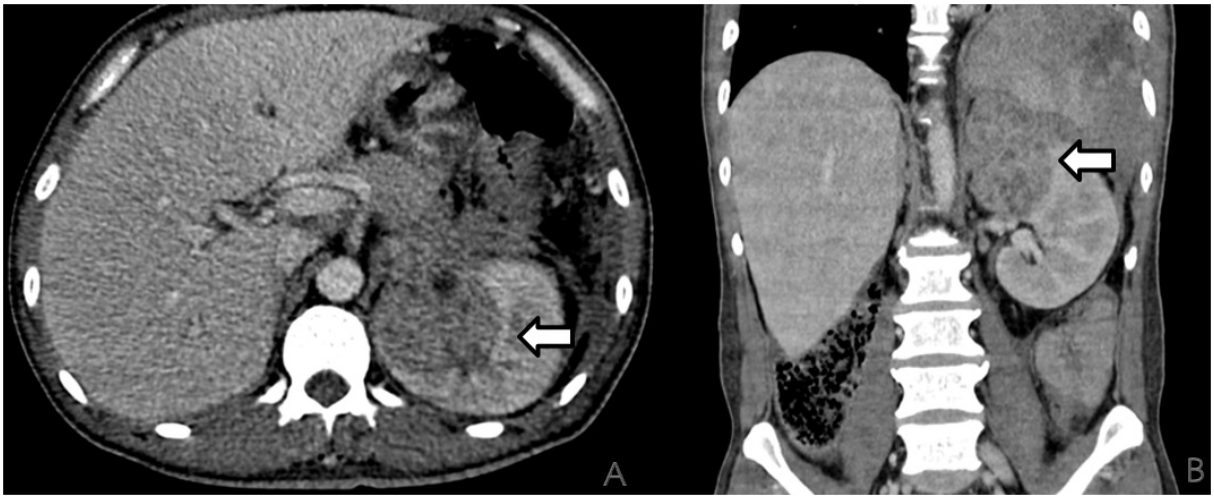

Figure 3. *A 47-year-old male with history of congenital single left kidney and presented with left flank pain. CT scan portovenous phase A) axial plane and B) coronal plane demonstrated multiple small rim-enhancing cystic lesions representing multiloculated abscess or inflammatory pseudotumor at upper pole of left kidney (arrow) involved left adrenal gland, spleen, and abdominal wall.*

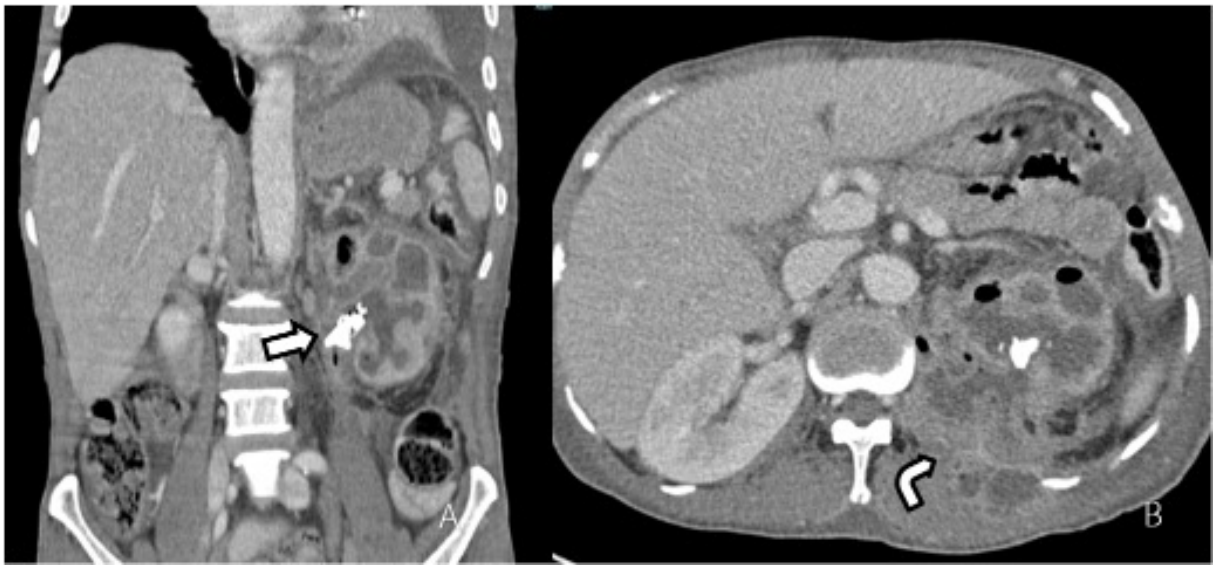

Figure 4. *A 60-year-old male known case type 2 Diabetes Mellitus presented with back pain, fever and palpable left flank mass. CT scan portovenous phase A) coronal plane and B) axial plane demonstrated multiple renal-pelvic stones (arrow) and hydronephrosis. Emphysematous pyelonephritis was noted with perinephric abscess of the left kidney involved psoas muscle and extension to posterior pararenal space and the posterior abdominal wall (curve arrow).*

In two cases were finally diagnosed with hepatic actinomycosis. One patient presented with recurrent cholangitis, and imaging demonstrated intrahepatic duct dilatation with an enhanced wall and an intrahepatic duct stone. Additionally, left portal vein thrombosis was observed, along with left lobe atrophy, which represented chronic cholangitis (Figure 5). In another case, a liver abscess initially presented as a mimic of a liver mass. Upon further investigation, biopsy was performed, and the results conclusively confirmed the presence of actinomycosis. A case of a palpable abdominal wall mass and CT demonstrated an ill-defined enhancing subcutaneous lesion at the mid-anterior abdominal wall (above the umbilicus and without umbilical involvement) with extension to the adjacent peritoneum and intra-abdominal fat reticulation.

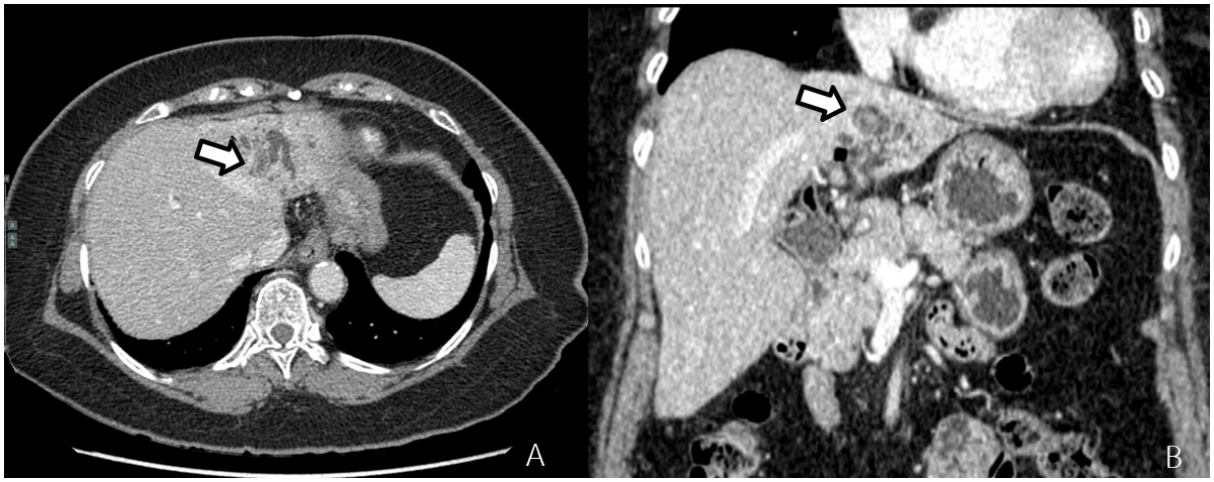

Figure 5. *A 76-year-old female with right upper quadrant pain; CT scan portovenous phase A) axial plane and B) coronal plane demonstrated chronic cholangitis at the left lobe of the liver; intrahepatic duct dilatation and intrahepatic duct stone (arrow).*

Surgical treatment and pathological characteristics, almost all the patients underwent surgical treatment (n=12, 92.3%). The diagnosis of actinomycosis was histologically confirmed in all cases. The modes of surgical treatment are summarized in Table 1. The mean hospital admission was 11.1 days (range, 1-36 days). The duration of treatment was less than 2 months in all patients (Table 1).

Discussion

Actinomycosis is a chronic suppurative bacterial infection caused by Actinomyces species. Actinomyces israelii is the organism most commonly found in humans. Actinomycosis usually manifests as abscess formation, dense fibrosis, and sinus drainage. The disease is further characterized by its tendency to spread extensively beyond the normal fascial and connective tissue planes. Disease manifestations can occur in various body regions, including the cervicofacial, thoracic, and abdominal areas. The majority of cases involve the face and neck (50-65%), followed by the chest (15-30%), and the abdominal region (approximately 20%). Pelvic involvement in the inguinal region is less common (3-5%) [3]. Infections typically progress slowly. Actinomycetes usually do not penetrate normal organ tissues, and infection results from the destruction of a normal mucosal barrier. This destruction can be attributed to accidents, surgical procedures, immunosuppression, or the introduction of foreign bodies, such as intrauterine devices or stones. A history of tissue damage, such as acute perforated appendicitis or diverticulitis, immunosuppression, or diabetes mellitus, poses a significant risk for Actinomycosis [1-3].

In cases of actinomycotic disease involving the bowel, the common CT finding is concentric wall thickening accompanied by a cystic or solid mass in the vicinity of the affected bowel segment [3]. In the large intestine, the cecum and transverse colon are frequently affected. Misdiagnosis can affect treatment decisions, potentially leading to a shift from localized surgery to more extensive procedures, including extended colon resection, which is often performed for cancer treatment [4-6].

Pelvic actinomycosis is strongly correlated with long-term intrauterine device usage [7-10]. Correlated with this study, two patients had a history of intrauterine device use of 12 and 30 years. Additionally, it can arise as an extension of abdominal actinomycosis, often stemming from latent ileocecal diseases. In such cases, the ovaries and fallopian tubes are frequently affected. Tubo-ovarian actinomycosis, a subtype of pelvic actinomycosis, tends to exhibit a more solid appearance

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than typical tubo-ovarian abscesses in the adnexal region. Moreover, pelvic actinomycosis has the potential to spread extensively to various adjacent structures, including the uterus, urinary bladder, rectal area, urachus, abdominal wall, and peritoneum [3]. This comprehensive involvement was also observed in this study.

Radiological imaging is integral to the diagnostic process, providing detailed insights into abnormalities and lesion boundaries. Computed Tomography (CT) scans are commonly utilized to evaluate masses or infections in the abdominal region. These scans may reveal characteristic patterns, such as solid masses with focal low-attenuation areas, more prevalent than cystic forms. Rim-enhancing lesions may also be observed, along with evidence of extension into adjacent tissues, creating potential diagnostic confusion with cancer [1-3]. Differential diagnoses include tuberculosis, Crohn's disease, and other inflammatory conditions. However, these modalities confirm the presence of masses or abscesses without distinguishing actinomycosis from malignancies, inflammatory bowel diseases, or infectious conditions, given the prevalence of solid masses with focal low-attenuation areas in this disease [1].

The review of the literature emphasizes that actinomycotic infection should be considered diagnostically in three specific clinical circumstances : (a) a series of manifestations including chronicity, extensive propagation across tissue planes, and firm to hard mass-like features, which are frequently confused with malignant disease; (b) drainage of an abscess by a sinus tract, which may spontaneously close and reform elsewhere; and (c) temporary improvement after a short course of antibiotic treatment, followed by frequent relapses [3]. Definitive diagnosis involves the identification of sulfur granules, conglomerates of filamentous bacteria, often accompanied by white blood cells, particularly neutrophils, in surgically obtained tissue samples (Figure 6). The limitation of the study is selection bias because the radiologists who re-interpreted the CT findings already knew the diagnosis of the patients, making the situation less authentic.

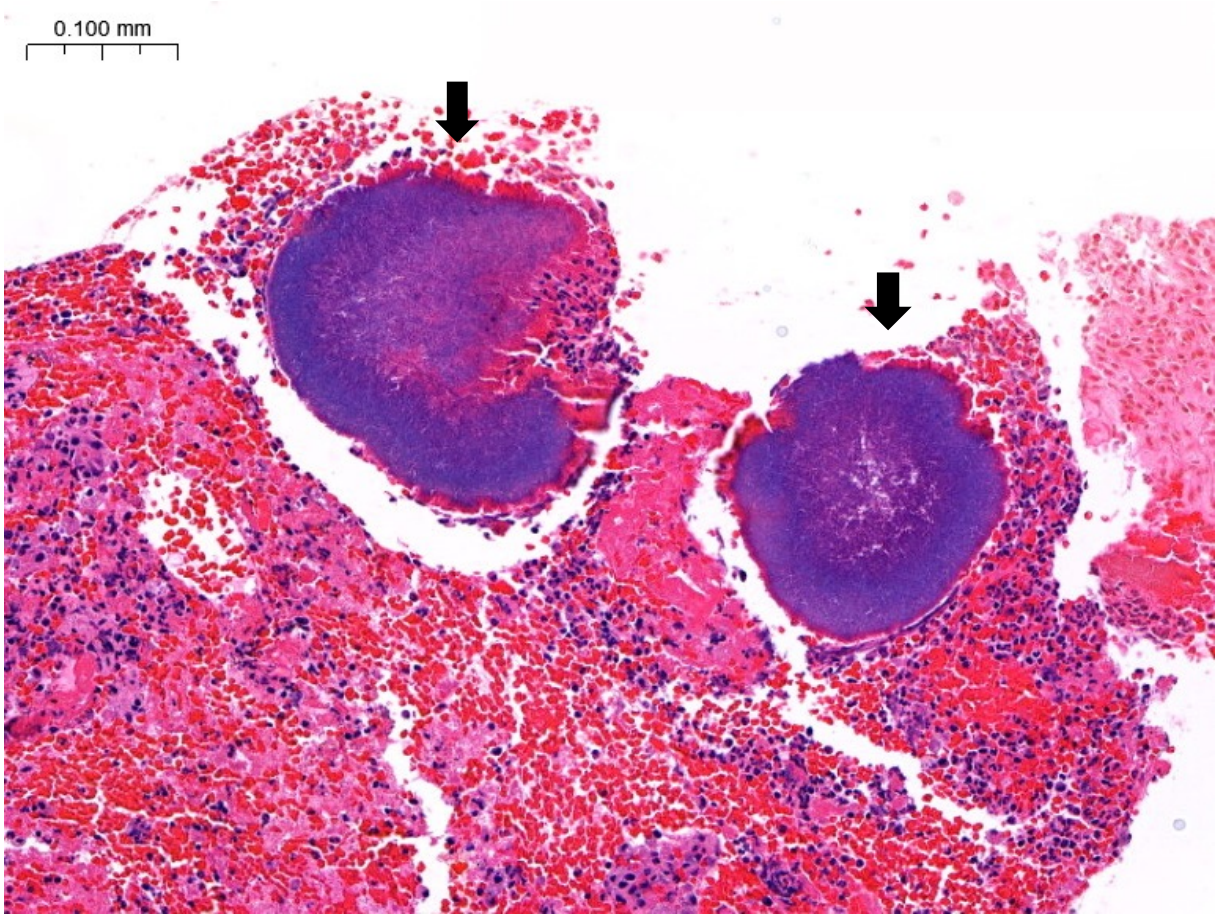

Figure 6. *The histologic section of liver biopsy showed filamentous gram positive bacterial colonies (arrow) in the inflammatory tissue background. (hematoxylin-eosin stain; H&E stain, original magnification x200).*

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Conclusion

The key points of chronic clinical presentation, and CT imaging of abscess-liked lesion with an infiltrative pattern, associated with the fistula tract, retained foreign body or foreign body related history help clinicians and radiologists consider of this infection. That leads to proper management for patients. However, tissue diagnosis or pathogen identification are necessary for a definite diagnosis in case of tumor-mimic (inflammatory or pseudotumor formation) and for specific medical antibiotic treatment. CT serves as a valuable tool for monitoring the resolution or recurrence of abdominal actinomycosis. The duration of an antibiotic therapy should be tailored to each individual, optimizing the treatment plan based on the unique response of the patient.

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Author contributions: All authors conceived of the presented idea, contributed to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript.

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