

## CASE REPORT

# A 6-year-old boy with a focal lesion of the liver: case description

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## ABSTRACT

Liver abscess is rare in the pediatric population, but it can be a challenge for physicians. The clinical symptoms of liver abscesses are nonspecific, which may lead to a delay in diagnosis and initiation of treatment.

We present a case of a 6-year old boy with a hepatic abscess, probably resulting from inflammatory changes in the sinuses. Due to the unfavorable location, surgical intervention was abandoned. Complete regression of the lesion was observed following the implementation of conservative treatment. The article also presents a broad differential diagnosis of focal liver lesions, which can aid in establishing an accurate diagnosis in clinical practice.

## KEY WORDS:

*Streptococcus intermedius*, liver abscess, liver focal lesion.

## CASE REPORT

A 6-year-old boy was admitted to the Pediatric Department due to fever and abdominal pain. In the interview, it was revealed that the boy had been experiencing fever every 4 hours for the past 4 days, reaching a maximum of 39.5°C, with a poor response to antipyretic medications. Additionally, for the past 2 days, he complained of crampy abdominal pain localized in the right lower quadrant. Furthermore, over the past few days, due to a respiratory tract infection characterized by symptoms such as rhinitis and non-productive cough, he had been receiving budesonide and bronchodilators. There was no history of international travel, including tropical regions, or contact with animals. Upon admission, the boy was in a generally good condition but significantly weakened. The physical examination revealed an enlarged liver, but no other abnormalities or signs of infection were observed. Laboratory tests conducted upon admis-

sion showed elevated inflammatory markers (C-reactive protein 360 mg/l, procalcitonin 16 ng/ml), elevated transaminase levels (alanine aminotransferase 73 U/l, aspartate transferase 51 U/l), gamma-glutamyl transferase (97 U/l), and hypoalbuminemia (33.4 g/l). Abdominal ultrasonography (USG) revealed a heterogeneous, polycyclic area of reduced echogenicity measuring 37 × 34 × 40 mm in the right lobe of the liver, with weak peripheral flow. Additionally, the liver was enlarged, and the parenchyma surrounding the lesion was heterogeneous. Further diagnostic investigation with abdominal computed tomography (CT) scan showed a multiloculated fluid collection in segments 6 and 7 of the right lobe of the liver, with proteinaceous content and numerous septations extending to the center, with mild contrast enhancement (Figure 1). Empirical antibiotic therapy with ceftriaxone and metronidazole was initiated.

During the first 4 days of hospitalization, the boy had high fever and complained of severe abdominal pain

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localized in the right upper abdomen. Additionally, his mother noticed a deterioration in his hearing. A head CT scan was performed, revealing intensified inflammatory changes in the structures of the temporal bone pyramids, bilateral involvement of the auditory ossicles with inflammatory masses and inflammatory changes in the paranasal sinuses. The presence of focal lesions in the central nervous system was ruled out.

Due to the identified focal lesion in the liver, a comprehensive differential diagnosis was conducted. In the performed serological tests, negative antibodies against both classes of Epstein-Barr virus (EBV), cytomegalovirus (CMV), and *Mycoplasma* were found, along with negative antibodies against *Echinococcus* spp. and *Entamoeba histolytica*, negative circulating antigen of *Aspergillus* spp., and a double (Ag/Ab) HIV test. The test for antibodies against SARS-CoV-2 was positive in the IgG class. The stool parasitological examination was negative.

## FINAL DIAGNOSIS

On the 4<sup>th</sup> day of hospitalization, information was received about the growth of *Streptococcus intermedius* in the blood culture and about a questionable result of testing for the circulating *Candida albicans* antigen.

Due to the positive blood culture result, the diagnosis of liver abscess was made, most likely originating from inflammatory changes in the sinuses and temporal bones. After obtaining information about the pathogen, the antibiotic therapy was modified to target based on ceftriaxone and vancomycin. Additionally, considering the uncertain result of circulating *C. albicans* antigen, voriconazole was added to the treatment.

Due to the diagnosis of a liver abscess, immunological diagnostics were also expanded, confirming normal lymphocyte levels, an elevated immunoglobulin response to the infection, and normal bactericidal function of granulocytes (excluding chronic granulomatous disease – CGD). The consulting immunologist recommended further diagnostic expansion in the event of recurrent bacterial infections or treatment failure.

## HOSPITAL COURSE

The case of the boy was presented at the surgical-radio logical consultation. After reviewing the available test results, the consulting specialists decided not to proceed with surgical intervention due to the unfavorable location of the liver abscess in the 6<sup>th</sup> and 7<sup>th</sup> segments of the right hepatic lobe. They recommended continuing with conservative treatment.

The antibiotic therapy was continued, with an improvement in the general condition and a reduction in inflammatory parameters being observed. After obtaining complete information about the drug sensitivity of *Strep-*



**FIGURE 1.** CT – multiloculated fluid collection in segments 7 and 6 of the right lobe of the liver, measuring 46 × 38 mm. The fluid content is proteinaceous. Numerous septations extending to the center of the lesion, with mild enhancement of the capsule. Disturbed perfusion of the liver parenchyma in the vicinity of the lesion

*tococcus intermedius*, the decision was made to discontinue vancomycin. However, a fever relapse and an increase in inflammatory parameters were observed. Vancomycin was reintroduced, resulting in the resolution of symptoms and gradual normalization of biochemical parameters.

During hospitalization, abdominal USG was performed multiple times, showing a slight regression of the abscess. On the 26<sup>th</sup> day of targeted treatment, an abdominal MRI was conducted, and also demonstrated partial regression of the lesion. The boy was examined by surgical specialists several times, and the decision for conservative treatment was upheld. The treatment with vancomycin and ceftriaxone was continued for a total of 42 days.

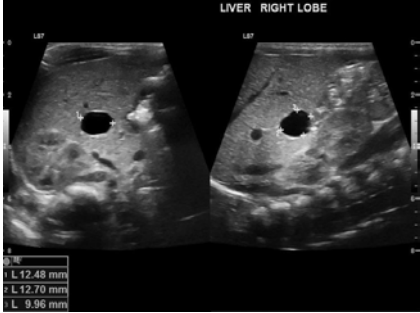
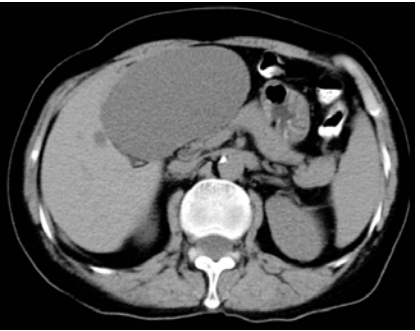
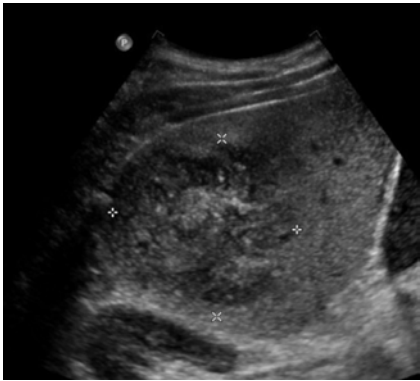
After discharge, the boy was placed under the care of the Surgical Outpatient Clinic. During follow-up imaging examinations, further regression of the lesion was observed until its complete resolution, which occurred 6 weeks after the end of antibiotic therapy.

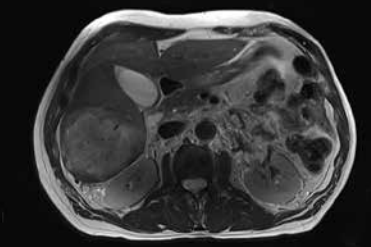
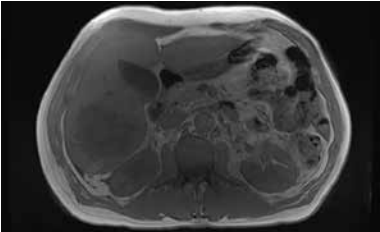
## DISCUSSION

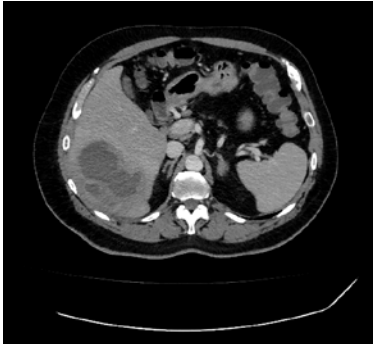
Liver focal lesions can have diverse characteristics. They can be cystic or solid, of congenital or acquired etiology (including infectious or neoplastic). Various imaging techniques (USG, CT, MRI) are used for the differentiation of these lesions, and in cases where diagnosis is challenging, a biopsy of the lesion is performed for histopathological verification. The characteristic clinical features and imaging findings are presented in Table 1.

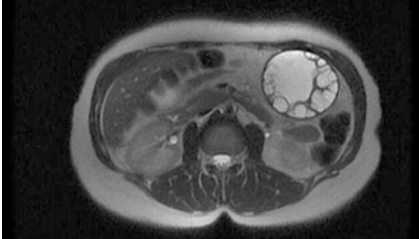
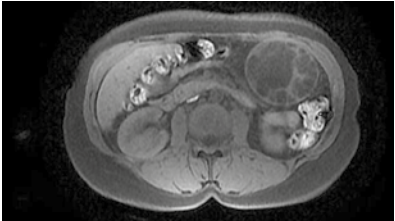
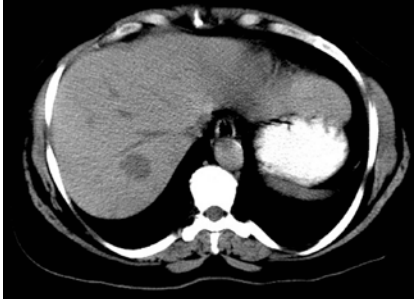
According to their etiology, liver abscesses can be classified into bacterial, fungal, and amebic types. Bacterial abscesses are the most commonly observed [6]. Bacteria can enter the liver through the bloodstream, bile or via contiguous spread from infected surrounding tissues [5].

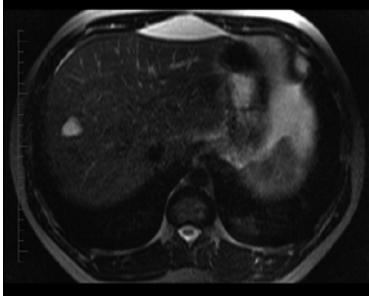
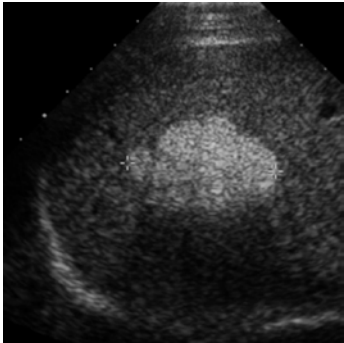
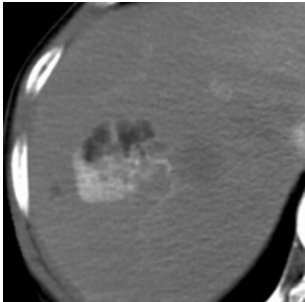
TABLE 1. Characteristic features of the most common focal liver lesions

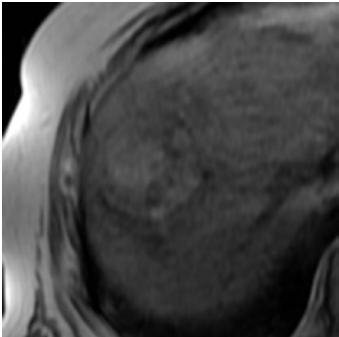
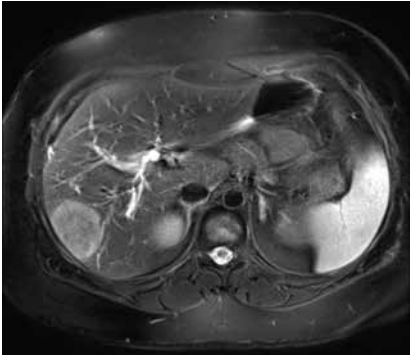
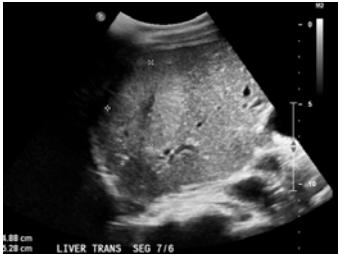
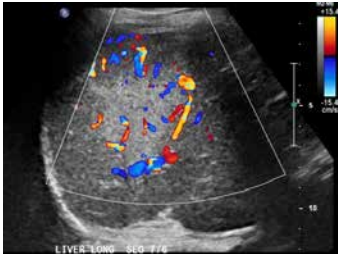
| Type of lesion         | Imaging studies                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Clinical course                                                                                                        | Remarks                                                                                                                                       |
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| Cystic lesions         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                        |                                                                                                                                               |
| Simple cyst            | <p><b>USG:</b> Round or oval, well-defined hypoechoic focal lesion with increased echogenicity behind the lesion [1, 15].</p>  <p><i>Case courtesy of Maulik S Patel, radiopaedia.org, rID: 73651</i></p> <p><b>CT/MRI:</b> Hypodense lesion, without enhancement after contrast administration [17].</p>  <p><i>Case courtesy of Frank Gaillard, radiopaedia.org, rID: 4958</i></p> | <p>Asymptomatic [1].</p> <p>Large lesions can cause abdominal pain and a feeling of fullness in the upper abdomen.</p> | <p>Arises from developmental disorders of the bile ducts [17].</p>                                                                            |
| Pyogenic liver abscess | <p><b>USG:</b> Round or oval lesion, with decreased and heterogeneous echogenicity. It contains a dense fluid; fluid level may be visible. Additionally, the lesion is surrounded by a hyperechoic capsule [3].</p>  <p><i>Case courtesy of Bruno Di Muzio, radiopaedia.org, rID: 62849</i></p>                                                                                                                                                                      | <p>Fever, upper abdominal pain, nausea, vomiting, weight loss [1].</p>                                                 | <p>In the tests, leukocytosis, elevated inflammatory markers, hypoalbuminemia and increased levels of aminotransferases are observed [5].</p> |

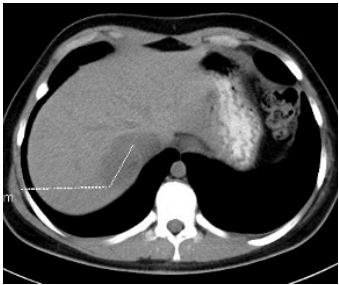
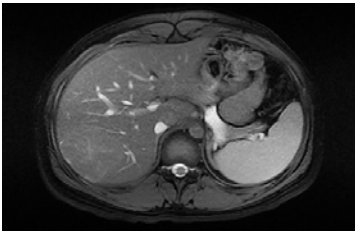
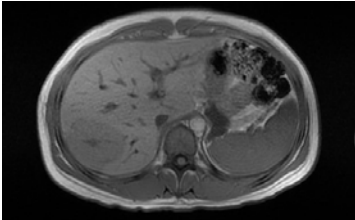
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| <p><b>Amoebic liver abscess</b></p> | <p><b>CT:</b> Hypodense lesion with irregular margins, showing a double-rim enhancement pattern after contrast administration, forming a highly vascularized granulation tissue. It is surrounded by a zone of hypoperfusion caused by impaired blood supply to the liver parenchyma [1].</p>  <p><i>Case courtesy of Natalie Yang, radiopaedia.org, rID: 7017</i></p> <p><b>MRI:</b> In the T2-weighted sequence, the pus content appears hyperintense, while in the T1-weighted sequence, it appears hypointense [22].</p>  <p>T2-weighted sequence.</p> <p><i>Case courtesy of Bruno Di Muzio, Radiopaedia.org, rID: 62849</i></p>  <p>T2-weighted sequence.</p> <p><i>Case courtesy of Bruno Di Muzio, Radiopaedia.org, rID: 62849</i></p> <p><b>USG:</b> Round or oval, well-demarcated hypochoic lesion, typically located in the posterior segments of the liver, close to the capsule [17].</p>  <p><i>Case courtesy of Ashesh Ishwarlal Ranchod, radiopaedia.org, rID: 163222</i></p> | <p>Fever, upper abdominal pain, nausea, vomiting, weight loss.</p> | <p>In the tests, leukocytosis, elevated inflammatory markers, hypoalbuminemia and increased levels of aminotransferases are observed.</p> |
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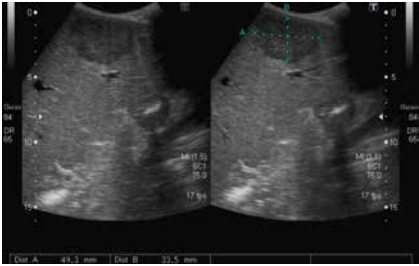
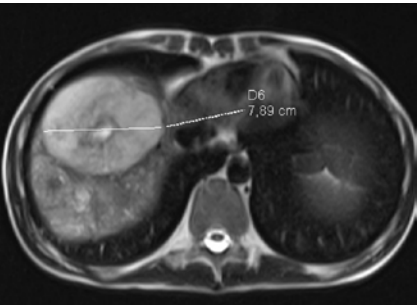
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|                             | <p><b>CT:</b> Well-demarcated, oval-shaped lesion filled with fluid, showing local edema [17]. Septations or fluid levels may be visible inside.</p>  <p><i>Case courtesy of Ashesh Ishwarlal Ranchod, radiopaedia.org, rID: 163222</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                            |                                                          |
| <b>Fungal liver abscess</b> | <p><b>USG:</b> Small, scattered, round lesions with decreased echogenicity, surrounded by a hyperechoic capsule.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                            |                                                          |
| <b>Hydatid cyst</b>         | <p><b>USG:</b> Young cysts have the appearance of a simple cyst, while older ones have a double-layered capsule with visible separation of the inner membrane and internal calcifications and reflections, known as "hydatid sand" [1, 15]</p>  <p><i>Case courtesy of Dylan Kurda, Radiopaedia.org, rID: 23232</i></p> <p><b>CT:</b> Hypodense lesion, often with peripheral areas of calcification. Septations and daughter cysts may be visible inside. The „water lily sign,” caused by the detachment of the inner membrane of the capsule, may also be observed [26].</p>  <p><i>Case courtesy of Mohammadtaghi Niknejad, radiopaedia.org, rID: 82743</i></p> | <p>Slow growth of the cyst.</p> <p>Symptoms occur in cases of large cyst size, bacterial infection, or cyst rupture, which can trigger a severe allergic reaction [1].</p> | <p>Most commonly <i>Echinococcus granulosus</i> [15]</p> |

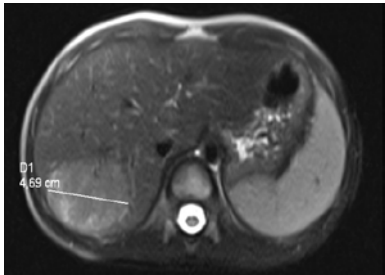
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|                             | <p><b>MRI:</b> In the T2-weighted sequence, the pus content appears hyperintense and the septations and daughter cysts are clearly visible. In the T1-weighted sequence, the lesion appears hypointense [26].</p>  <p>T2-weighted sequence.<br/><i>Case courtesy of Bahman Rasuli, Radiopaedia.org, rID: 149354</i></p>  <p>T1-weighted sequence.<br/><i>Case courtesy of Bahman Rasuli, Radiopaedia.org, rID: 149354</i></p>                                |                                                                                                            |                                                                                                                                                                                  |
| <b>Solid benign lesions</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                            |                                                                                                                                                                                  |
| <b>Hemangioma</b>           | <p><b>USG:</b> A focal lesion with increased echogenicity and well-defined borders in the liver parenchyma, without flow on Doppler examination. Larger hemangiomas have a heterogeneous structure [10, 15].</p>  <p><b>CT:</b> A hypodense lesion, well-defined, shows slow filling from the periphery to the center after contrast agent administration [10, 13].</p>  <p><i>Case courtesy of Hani Makky Al Salam, radiopaedia.org, rID: 10052</i></p> | <p>In the case of large sizes, there may be upper abdominal discomfort, early satiety, and nausea [1].</p> | <p>Composed of dilated sinusoidal vessels [1].</p> <p>Risk of bleeding in case of injury [13].</p> <p>Typically, spontaneous regression of the tumor occurs by the age of 2.</p> |

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| <p><b>Adenoma</b></p> | <p><b>MRI:</b> In the T2 sequence, the lesion appears as a focal area with high signal intensity. In the arterial phase, a typical feature of a hemangioma is peripheral nodular enhancement. In the venous phase, there is centripetal filling of the tumor with contrast [1, 13].</p>  <p><i>Case courtesy of Frank Gaillard, radiopaedia.org, rID: 8155</i></p> <p><b>USG:</b> A lesion with varied echogenicity, often with visible calcifications; it may be surrounded by a hypoechoic zone; typically located subcapsularly in the right lobe [27].</p>  <p><i>Case courtesy of Natalie Yang, radiopaedia.org, rID: 6951</i></p> <p><b>CT:</b> After contrast administration, the lesion rapidly enhances in the early arterial phase from the periphery to the center, and in the venous phase it becomes isodense. Hemorrhagic changes are visualized as hyperdense focal lesions [27].</p>  <p>Arterial phase.<br/><i>Case courtesy of Natalie Yang, radiopaedia.org, rID: 6951</i></p> | <p>The risk of transformation into hepatocellular carcinoma (HCC) is approximately 5% [1].</p> | <p>Increased risk is observed in women taking oral contraceptives, as well as in children taking glucocorticosteroids, with MODY-3 diabetes, galactosemia, or glycogen storage diseases type I and III [1, 10, 15].</p> |
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| <p><b>Focal nodular hyperplasia</b></p> | <p><b>MRI:</b> In the T1-weighted sequence, the lesion appears isointense, while in the T2-weighted sequence, it appears hyperintense. After contrast administration, there is enhancement in the arterial phase with delayed contrast washout.</p>  <p>T1-weighted sequence.<br/><i>Case courtesy of Natalie Yang, radiopaedia.org, rID: 6951</i></p>  <p>T2-weighted sequence.<br/><i>Case courtesy of Paul Simkin, radiopaedia.org, rID: 33368</i></p> <p><b>USG:</b> A polycyclic lesion, without a capsule, with a central scar from which connective tissue bands radiate [10, 15].</p>   <p><i>Case courtesy of Bruno Di Muzio, Radiopaedia.org, rID: 68936</i></p> | <p>Most commonly asymptomatic [1, 10].</p> | <p>It arises as a result of liver regeneration caused by disturbances in blood flow [10, 13].</p> <p>2–7% of focal liver lesions in children [13, 24].</p> |
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|  | <p><b>CT:</b> Focal hypodense lesion, strongly enhances in the arterial phase after contrast administration, leaving an unenhanced scar, which, in turn, enhances in the venous phase [24].</p>   <p>Arterial phase.<br/><i>Case courtesy of Mohammadtaghi Niknejad, Radiopaedia.org, rID: 64211</i></p> <p><b>MRI:</b> In the T1 sequence, the lesion is isointense compared to the liver, while it is isointense or slightly hyperintense on T2-weighted images. The central scar is typically hypointense on T1-weighted images and hyperintense on T2-weighted images, and it may exhibit delayed contrast enhancement [24, 25].</p>   <p>T2-weighted sequence.<br/><i>Case courtesy of Bruno Di Muzio, Radiopaedia.org, rID: 68936</i></p> |  |  |
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| Solid malignant lesions  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                            |                                                                                                                                      |
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| Hepatocellular carcinoma | <p><b>USG:</b> A homogeneous lesion with reduced echogenicity; in lesions &gt; 3 cm, fibrosis and focal necrosis appear, making the image heterogeneous [15]; satellite foci appear around large tumors [1].</p>  <p><i>Case courtesy of Hani Makky Al Salam, radiopaedia.org, rID: 21229</i></p> <p><b>CT:</b> A hypodense and heterogeneous lesion; after contrast administration, it enhances in a non-homogeneous manner in the arterial phase; it may infiltrate the vessels of the portal and systemic circulatory system [27].</p>  <p><b>MRI:</b> After contrast administration, the lesion enhances in the arterial phase compared to the surrounding liver parenchyma and shows decreased enhancement in the venous phase [1, 14].</p>  | <p>Commonly found in cirrhotic liver [1, 15].</p> <p>Symptoms of decompensated liver cirrhosis: jaundice, encephalopathy, ascites; additionally, bleeding from esophageal varices [1].</p> | <p>Prognostic worsening factors: large size, vascular invasion, metastases [1].</p> <p>Rarely found in the pediatric population.</p> |

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| <p><b>Hepato-<br/>blastoma</b></p> | <p><b>USG:</b> Large lesions have diverse echogenicity and intratumoral calcifications may be visible within the lesion.</p>  <p><i>Case courtesy of Yair Glick, radiopaedia.org, rID: 73479</i></p> <p><b>CT:</b> Heterogeneous, hypodense lesion with areas of necrosis and bleeding.</p>  <p><b>MRI:</b> Heterogeneous, hypointense lesion in the T1 sequence, hyperintense in the T2 sequence, with areas of necrosis and bleeding [14].</p>  <p>T2-weighted sequence.</p> | <p>Non-specific abdominal symptoms, jaundice, vomiting.</p> <p>Palpable masses of the tumor [10].</p> | <p>The most common primary malignant liver tumor in children [10, 11].</p> <p>It can be associated with prematurity, Beckwith-Wiedemann syndrome, hemi-hypertrophy, and a family history of colorectal polyposis [10, 14].</p> |
| <p><b>Lymphoma</b></p>             | <p><b>USG:</b> Hypoechoic lesion, sometimes with a hyperechoic center, peripherally vascularized</p>  <p><i>Case courtesy of Yair Glick, radiopaedia.org, rID: 94408</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <p>Abdominal pain, jaundice, weight loss.</p>                                                         | <p>It occurs rarely.</p> <p>More commonly seen in individuals with reduced immunity.</p> <p>HCV or EBV infection is detected in 40–60% of cases [1].</p>                                                                       |

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|  | <p><b>CT:</b> Single, hypodense lesion, showing weak contrast enhancement, necrosis or bleeding into the lesion may be seen.</p>  <p>Case courtesy of Yair Glick, radiopaedia.org, rID: 94408</p> <p><b>MRI:</b> Heterogeneous, hypointense lesion in the T1 sequence, hyperintense in the T2 sequence, with delayed enhancement in the venous phase.</p> |  |  |
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Risk factors include immunodeficiencies such as CGD, diabetes mellitus, oncological conditions, chemotherapy, and malnutrition. In immunocompetent patients, predisposing factors include intra-abdominal infections, bacteremia, and iatrogenic complications, such as umbilical vein catheterization and percutaneous liver biopsy [6, 16, 22, 23].

The most common etiological factor is Gram-negative enteric bacilli, which can originate from gastrointestinal tract perforation or appendicitis. Additionally, staphylococci or streptococci can cause abscesses in cases unrelated to the gastrointestinal tract [1]. In the described case, the most likely source of infection was sinusitis and middle ear infection with involvement of the temporal bone caused by *Streptococcus intermedius*. This is a Gram-positive, beta-hemolytic bacterium belonging to the *Streptococcus anginosus* group [2], which constitutes a normal part of the gastrointestinal and respiratory microbiota. In specific situations, such as dental procedures or abscesses in the head and neck region [2, 9], it can cause invasive infections [8].

The clinical symptoms of liver abscesses are nonspecific and most commonly include high fever, weakness, upper abdominal pain, nausea, vomiting, night sweats and weight loss. In laboratory tests, attention is drawn to leukocytosis, elevated markers of inflammation, hypoalbuminemia and increased levels of aminotransferases [5]. Such a presentation was also observed in the present patient; however, due to the nonspecific nature of these symptoms, the diagnosis required further diagnostic investigation.

Various imaging techniques are used in the diagnostic evaluation of liver abscesses. In abdominal X-rays, the abscess appears as an oval lesion with a fluid level, located outside the intestinal lumen. In USG, the abscess is visualized as a hypoechoic, heterogeneous lesion filled

with dense material, often with a fluid level or additional echoes due to the presence of necrotic tissues, surrounded by a hyperechoic capsule [3]. For a more detailed assessment of focal liver lesions, CT is used, with a sensitivity and specificity of 90% [3]. The typical imaging feature for liver abscesses is the “double target sign” [1], which consists of a hypodense lesion with irregular margins surrounded by a thick capsule that shows peripheral enhancement after contrast administration, and a surrounding zone of hypoperfusion.

Complications of liver abscess can include perforation with the formation of pleural, peritoneal or pericardial abscesses, and splenic or portal vein thrombosis [1]. The treatment depends on the patient's general condition, as well as the location and size of the abscess. Bacterial abscesses are often a complication of sepsis, so broad-spectrum antibiotic therapy is initiated before obtaining microbiological test results and then adjusted according to culture results [4].

Small abscesses (up to 3 cm) can be treated conservatively, which is supported by available literature data, such as a retrospective study conducted in 2008 by Dr. W. Hope, which demonstrated 100% effectiveness of antibiotic therapy alone in treating abscesses < 3 cm [7]. The duration of antibiotic therapy is usually around 4–6 weeks [6, 18].

In the case of larger lesions, risk of spontaneous rupture, or treatment failure – evidenced by persistent fever after 48–72 hours of antibiotic therapy, unrelenting symptoms, or further enlargement of the lesion – surgical intervention (aspiration biopsy or percutaneous drainage) should be considered. Surgical intervention is indicated for lesions above 5–6 cm in size [12, 18]. There are no clear guidelines for managing lesions 3–5 cm in size. In a study published in 2012 by Mangunkiya *et al.* [20], which included 400 patients with liver abscesses of varying sizes,

32% of patients required only conservative treatment. The remaining patients needed surgical intervention using aspiration techniques (mean abscess size of 6.87 cm) or drainage (in abscesses with a mean size of 11.5 cm).

## CONCLUSIONS

In developed countries, liver abscesses are rare in the pediatric population, but in developing countries, they still pose a significant problem [19]. The most common location for liver abscesses is the right lobe [21]. The treatment depends on the patient's condition and the location and size of the lesion. In the described case, a liver abscess with dimensions of 46 × 38 mm was identified. The location of the lesion in segments 6 and 7 of the right hepatic lobe made it impossible to perform minimally invasive surgery and was associated with a high risk of postoperative complications. Therefore, conservative treatment was pursued, using antibiotic therapy for a total of 6 weeks, resulting in clinical improvement and gradual reduction of the lesion until its complete resolution in imaging studies after 12 weeks.

## DISCLOSURES

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4. Conflicts of interest: None.

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