

Percutaneous treatment of liver abscess – outcomes

Tomasz Miłek, Piotr Ciostek

1st Department of General and Vascular Surgery, Medical University of Warsaw, Warsaw, Poland

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Address for correspondence: Dr Tomasz Miłek, 1st Department of General and Vascular Surgery, Warsaw Medical University, 8 Kondratowicza St, 03-242 Warsaw, Poland, phone: +48 604 422 345, e-mail: tomasz_milek@wp.pl

Abstract

Introduction: Mixed bacterial flora are responsible for the development of numerous abscesses, particularly those that are a consequence of systemic infection (septicaemia) originating from pathologies within abdominal organs or biliary ducts. The number and volume of abscesses may vary, which influences the method of treatment.

Aim: To assess the effectiveness of a minimally invasive percutaneous drainage of liver abscesses.

Material and methods: A total of 37 patients were treated for liver abscess in the years 2007–2016. The treatment involved sonographically guided percutaneous drainage of liver abscess.

Results: A total of 35 patients with a solitary abscess were successfully cured with minimally invasive percutaneous drainage. Two patients with abscesses volume > 20 cm³ were treated surgically after ineffective percutaneous drainage.

Conclusions: Percutaneous drainage is effective in the treatment of solitary liver abscesses volume < 5 cm³. Irregularly shaped abscesses are effectively drained with multisite drainage. Hybrid drainage (endoscopic and percutaneous) is a method of choice in the treatment of abscesses resulting from biliary duct obstruction. Statistical significance regarding inflammatory markers was found only for C-reactive protein (CRP), because it correlated with the effectiveness of drainage, i.e. the possibility of drainage effectiveness decreased with the increase in CRP values.

Introduction

Bacterial liver abscess is a condition resulting from a bacterial infection. Abscesses may be solitary or multiple. The main causes of the pathology include: *Enterococcus faecalis*, *Staphylococcus aureus*, *Escherichia coli*, or gut flora. The incidence of liver abscesses remains unchanged, but the aetiology is different due to changes in surgical and microbiological techniques. Therefore, biliary duct and diverticular pathologies have replaced appendicitis. Such a tendency is also reflected in this paper. The patients usually experience high-grade fever, shivers, and excessive sweating. Bacterial infection occurs via different routes. The route may be an ascending one from the biliary duct or portal, or from the hepatic artery, from adjacent organs, as a result of trauma, and without evident cause. According to statistical data, the death rate in developed countries is 2–12%. The prognosis is largely dependent on concomitant diseases or the response to treatment. Apart from physical examination and history taking, the diagnosis is mainly based on imaging studies with a particular role of ultrasound and computed tomography scans. Complementary information is obtained

from blood tests that show elevated inflammatory markers. The condition is traditionally treated with targeted antibiotic therapy and sonographically guided abscess drainage, or, in the case of failure, with surgical drainage. Numerous cases of ineffective percutaneous drainage prompted the analysis leading to the identification of the causes and determination of indications and principles and the type of patients in whom percutaneous drainage would prove effective.

Aim

The aim of the study was to assess the effectiveness of a minimally invasive percutaneous drainage of liver abscesses.

Material and methods

A total of 37 patients were treated for liver abscess in the years 2007–2016. Demographic data and the underlying cause of abscess development are presented in Table I.

Based on physical examination, history taking, and accessory examinations (ultrasound and computed tomog-

Table I. Demographic data

Parameter	Result
Age, mean (range) [years]	74 (68–81)
Number of women/men	12/25
The cause of liver abscess development:	
Biliary duct pathologies	29
Diverticular pathologies	6
Pneumonia	1
Unknown	1

raphy of the abdomen), a fluid collection was identified in the liver. The inflammatory markers including C-reactive protein (CRP) and leukocytosis confirmed the diagnosis. The size and then the volume of the abscess were determined using a computer program that used computed tomography data. The treatment method depended on the volume, number, and shape of the abscesses. Small solitary and multiple abscesses with volume < 3 cm³ were treated with percutaneous needle aspiration with subsequent culturing of the contents. Abscesses with volume 3–5 cm³ were treated with percutaneous drainage. Volume between 5 and 10 cm³ was also an indication for a percutaneous drainage procedure. Abscesses larger than 10 cm³ were treated percutaneously with multiple drains. Multiple drains were also used for hourglass-shaped abscesses in order to reach every cavity. Every drainage procedure was sonographically guided. The effectiveness was assessed on the basis of the reduction in the amount of drained purulent content and follow-up sonographic examination performed after 3–5 days of drainage and prior to drainage removal. Ineffective drainage with persistent elevated inflammatory parameters constituted

an indication for surgical drainage. All the patients were administered intravenous broad-spectrum antibiotics started on the first day of treatment and modified after culture results were specified (Table II). At the same time, we tried to determine the cause of the abscess. In the case of a mechanical obstruction of the biliary duct, we performed retrograde cholangiopancreatography in order to decompress the biliary duct.

Results

The results were subjected to statistical analysis. We analysed whether the volume of the abscess translated into the effectiveness of various methods of drainage.

The analysis indicated that the volume of the abscess is statistically significant and associated with the effectiveness of drainage with χ^2 ($df = 3$) = 11.711; $p = 0.008$. The frequency distribution in a contingency table indicated that the effectiveness of drainage decreased substantially with abscesses larger than 5 cm³.

The analysis indicated that the type of drainage was not statistically significant and associated with the effectiveness of drainage with χ^2 ($df = 3$) = 5.017; $p = 0.171$.

Moreover, logistic regression analysis was performed using a LOGIT function converted with a dichotomous dependent variable (the effectiveness of drainage) on probability distribution. Analysis results showed that only the value of CRP was significantly associated with the probability of effective drainage. Based on the maximum likelihood estimation, it can be stated that the probability of effective drainage decreases with an increase in CRP values.

Discussion

Liver abscess was first described by Hippocrates in 400 BC [1]. In 1938, Ochsner described surgical drain-

Table II. Microorganisms isolated in the cultures of pus

Organism	Sensitivity	No. of patients
<i>Escherichia coli</i>	Cotrimoxazole, Amoxicillin, Amoxicillin + clavulanic acid, Cefotaxime, Ceftriaxone, Aminoglycosides, Fluoroquinolones	26
<i>Klebsiella pneumoniae</i>	Cotrimoxazole, Cefotaxime, Ceftriaxone, Aminoglycosides, Imipenem, Fluoroquinolones	29
<i>Enterobacter</i> sp.	Cefotaxime, Ceftriaxone, Aminoglycosides, Imipenem, Cotrimoxazole, Fluoroquinolones	6
<i>Pseudomonas aeruginosa</i>	Ceftazidime, Ceftriaxone, TMP/SMX, Aminoglycosides, Imipenem, Fluoroquinolones	1
<i>Staphylococcus aureus</i>	Methicillin, Oxacillin, Cephalosporins, Macrolides, Clindamycin, Rifampicin, Cotrimoxazole, Teicoplanin, Vancomycin, Netilmicin	4
<i>Microaerophilic streptococci</i>	Imipenem	8
<i>Bacteroides fragilis</i>	Sulbactam, Ampicillin	6

age of liver abscess in a landmark paper. This aggressive approach resulted in a high death rate, reaching 60–80% [2]. The progress in radiological and therapeutic diagnostics connected with precise microbiological identification reduced the death rate to the level of < 5–30% [3–5]. No deaths were reported in our patients during treatment. Liver abscesses are usually multiple, and solitary ones are most commonly located in the right liver lobe. The death rate following conventional surgical treatment and systemic antibiotic therapy ranges from 11.5% to 34% [6–8]. The role of surgical drainage gradually diminishes, and the procedure is more commonly replaced with percutaneous drainage [9–12]. The use of antibiotics only was recommended in the 1980s and is currently not indicated in this kind of treatment even in the most severe cases. The modality that is most commonly used is sonographically guided continuous percutaneous drainage of the abscess cavity. Its effectiveness ranges from 55% to 83% [13–16]. Fine-needle aspiration has never been popular in the treatment of liver abscess. Currently, it is most commonly used for sample collection in order to obtain cultures and analyse the abscess. In the present study the volume of abscesses was assessed on the basis of computed tomography scans. Professional literature only provides information about the largest sizes of abscesses. However, we assumed that the volume, location, and shape are the most significant in effective abscess drainage. Therefore, we divided the abscesses into four categories based on the volume: < 3 cm³, from 3 to 5 cm³, from 5 to 10 cm³, and > 10 cm³. This division was used to determine the technique of drainage. Apparently, the volume of the abscess was statistically connected with the drainage technique, with $p = 0.008$. The distribution in a contingency table indicated that the effectiveness of drainage decreased substantially with abscesses larger than 5 cm³. The present authors demonstrated, contrary to professional literature reports [17–20], that drainage may be effective after a single puncture and aspiration under sonographic control. However, the effectiveness of percutaneous drainage decreases in cases of irregularly shaped abscesses larger than 5 cm³ and located under the dome of the diaphragm. In this study, the volume of multiple liver abscesses ranged from 3 to 5 cm³, and they developed due to mechanical obstruction of the common bile duct. The standard treatment in such cases involved a hybrid procedure including abscess drainage and, shortly afterwards, endoscopic retrograde cholangiopancreatography to decompress the leakage of infected bile. Large abscesses are the most challenging as regards treatment [21–27]. Seemingly, a large volume of the collection is easy to puncture and drain. However,

the extensive inflammatory process manifested in the general patient status and markedly elevated leukocytosis and CRP are poor prognostic factors. Based on the maximum likelihood estimation, it may be stated that the probability of effective drainage decreases with an increase in CRP values. In our opinion, the underlying cause is connected with the dimensions of the abscess, which directly influences the defence mechanisms of the organ and produces septicaemia. Abnormal results of liver function tests corroborated the findings (aspartate aminotransferase – AST, alanine aminotransferase – ALT), and the immune system was additionally weakened by concomitant diabetes mellitus in 8 (21.6%) patients.

The drainage technique was selected depending on the volume of the abscess. Small abscesses (< 3 cm³) were emptied via a sonographically guided puncture because this technique facilitates emptying the whole abscess during a single procedure. A repeat biopsy was necessary in three patients due to a recurring abscess despite targeted antibiotic therapy. Abscesses larger than 3 cm³ required continuous drainage, so a drain was implanted into the abscess cavity under sonographic control. The drainage was left in situ until the cessation of purulent leakage, which lasted from 7 to 34 days. The shape of the abscess was very important in terms of the selection of a drainage technique. Multi-oculated hourglass-shaped abscesses were treated with numerous drains. This approach aimed at reaching each cavity to increase the effectiveness of the procedure. Although the terminology and definitions have been standardised, a large liver abscess has not been defined so far. Chung *et al.* [12] suggested that abscesses over 5 cm should be called “large”. It resulted from their experience showing that such a size necessitates a longer hospital stay, and the drainage is associated with a high risk of failure. Liao *et al.* [28] reported on the basis of computed tomography scans of 175 patients that abscesses larger than 7.3 cm are a risk factor as regards effective abscess drainage. In 2011, based on a sample of 63 patients, the same authors reported that the size of the abscess was insignificant in terms of treatment success rate. The mean abscess size was 6.5 cm in their study.

The present results showed that the volume of the abscess is statistically significant and associated with the effectiveness of drainage with χ^2 ($df = 3$) = 11.711; $p = 0.008$. The distribution in a contingency table indicated that the effectiveness of drainage decreased substantially with abscesses larger than 5 cm³.

Systemic antibacterial treatment remains the basic first-line treatment. The selection of a first-line antibiotic, before obtaining the results of abscess culture,

should comprise the most probable source of infection and a broad spectrum of pathogens. The recommended parenteral antibiotic therapy duration is 2–4 weeks, or until clinical, biochemical, and radiological improvement was obtained.

Conclusions

Percutaneous drainage is effective in the treatment of solitary liver abscesses volume < 5 cm³. Irregularly shaped abscesses are effectively drained with multisite drainage. Hybrid drainage (endoscopic and percutaneous) is a method of choice in the treatment of abscesses resulting from biliary duct obstruction. Statistical significance regarding inflammatory markers was found only for CRP, because it correlated with the effectiveness of drainage, i.e. the possibility of drainage effectiveness decreased with the increase in CRP values.

Conflict of interest

The authors declare no conflict of interest.

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