Ultrasound-Guided Percutaneous Treatment of Liver Abscesses: Long Term Results in a Single Center

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AIM: To analyze the results of ultrasound-guided percutaneous needle aspiration (PNA) and percutaneous catheter drainage (PCD) in the treatment of pyogenic liver abscesses. *Methods*: 71 patients (42 females and 29 males, average age 56.2±12.3) with pyogenic liver abscesses were treated with ultrasound guided PNA and/or PCD. Patients with liver abscess <50 mm and ≥50 mm in diameter were initially treated with PNA and with 8-French catheter drainage, respectively. The clinical characteristics, underlying diseases, organism spectra, therapeutic methods, and mortality rates were analyzed. *Results*: PNA was performed in 35 patients (49.3%) as initial treatment. In 14 patients needle aspiration was a definitive and successful treatment, while 17 out of 35 patients (48.6%) had a recurrence of abscess and required continuous catheter drainage. After PNA three patients were referred for surgery. In 13 patients PCD applied after PNA was a definitive and successful treatment, but 4 patients had to be transferred for surgery in this specific group. In 36 patients (50.7%) PCD was performed initially. In 12 patients PCD was performed twice. In all 7 deceased patients malignancy was the underlying condition. Forty-one patients (57.7%) underwent surgical interventions in the abdomen before percutaneous treatment. Cultures were positive in 54 patients (76 %). There were no complications related to the procedure. *Conclusion*: Ultrasound-guided percutaneous treatment of liver abscess is a safe and effective alternative to surgery, especially in critically ill patients. We recommend PNA and PCD as primary treatments for liver abscesses <50 mm and ≥50 mm in the longest diameter, respectively.

Key words: Interventional ultrasound, Needle aspiration, Catheter drainage, Pyogenic liver abscess.

Introduction

Pyogenic liver abscesses are usually caused by infection orginating in the biliary or intestinal tracts. This is potentially a life-threatening disease, and therefore, appropriate diagnosis and treatment are very important. Abdominal ultrasonografy and computerized tomography are most frequently used in the diagnosis of a liver abscess. The diagnosis can be confirmed by image-guided percutaneous aspiration and drainage, and subsequently, the appropriate therapy can be planned according to culture and antibiogram (1-3). In the past, the antibiotic therapy and surgical drainage were considered the treatments of choice for a liver abscess. Current therapeutic strategies established percutaneous drainage of liver abscesses instead of surgical treatment, with good results. This treatment is especially recommended in critically ill patients (4-7).

Continuous catheter drainage is now widely accepted and, in combination with antibiotics, is considered a safe and effective method of care for liver abscesses (8, 9). Some authors favour intermittent needle aspiration as equally effective and safe, but at the same time an easier, simpler, less aggressive, and cost-effective method (10-13).

Our study was undertaken to determine the current role of percutaneous ultrasound-guided drainage as an alternative to surgical treatment of liver abscesses, but also to analyze the role of needle aspiration and continuous catheter drainage in the treatment of liver absesses.

Patients and Methods

Patients

The records of patients, who underwent percutaneous treatment of pyogenic liver abscesses and were discharged from our hospital in the period from January, 1991 to May, 2002, were reviewed. Cases were identified by searching the hospital database of all patients discharged with the diagnosis of liver abscess during the study period. The diagnosis of liver abscess was made on the basis of clinical and imaging findings with ultrasound or computed tomography. The demographic, clinical, and laboratory findings, underlying diseases, organism spectra, abscesses' number and size, as well as mortality rates were analyzed. The size of abscess was recorded as the longest diameter in either solitary or multiple abscesses. The decision to opt either for percutaneous needle aspiration (PNA) or percutaneous catheter drainage (PCD) was made on the basis of the longest diameter of an abscess. Patients with the liver abscess shorter than 50 mm in maximal diameter were initially treated with PNA. In case of recurring abscess collection, an 8-French catheter for continuous drainage was introduced. Patients with abscess equal to or greater than 50 mm in diameter were initially treated with PCD.

All surviving patients were followed up clinically for six months after percutaneous treatment. Patients' response to treatment in terms of clinical symptoms and laboratory test results were monitored. The criteria for a successful treatment were set in regard to whether the infection had subsided clinically or whether there had been sonographic evidence of abscess resolution.

Patients were followed up in the out-patients' clinic bi-weekly after the discharge from the hospital. Clinical examination, white blood cell count and neutrophillia, CRP and abdominal ultrasonography were performed on every follow- up visit.

Antibiotics policy

Upon admission, all patients were treated with intravenous Ampicillin 500 mg qid, Cefuroxime 750 mg tid, and Metronidazole 500 mg tid. The antibiotics were adjusted according to the results of culture and sensitivity tests of pus aspirated at the time of the

drainage procedure. The antibiotics adjustment was done immediately after the sensitivity test result became available. Patients with negative culture results were continuously treated with a combination of Ampicillin, Cefuroxime, and Metronidasole. Intravenous antibiotics were continued for 10 days. If the antibiotic therapy was changed according to sensitivity test results, the new antibiotics were administered for 10 days. Patients were discharged earlier with a percutaneous intravenous catheter inserted for a completion of therapy, provided that fever had subsided for at least 48 hours. The patients were then administered the appropriate oral antibiotics for a six-week treatment period.

Intervention

All percutaneous interventions were performed under ultrasound guidance with a General Electric Logiq 400 machine and 3,5 MHz curvilinear transducer (General Electric, Chicago, USA). A free-hand technique using an 18 Gauge disposable trocar needle (Boston Scientific, Boston, USA) of varying lengths (10-16cm) was employed for puncturing of abscesses. A sample of pus was routinely taken and sent for microbiological analysis, including microscopy, culture and antibiotics sensitivity tests.

Percutaneous drainage

Two to five mililiters of undiluted contrast media were instilled slowly under fluoroscopic control into the abscess cavity through the 18 G needle to guide insertion of a 0,038" Amplatz extra-stiff into the abscess. After serial dilatation, an 8F multisidehole pigtail catheter (Boston Scientific, Boston, USA) was inserted into the largest cavity of the abscess. Aspiration was then performed with the catheter until no more pus could be removed. The catheter was then secured to the skin for continuous external drainage and the patient was sent back to the ward. When catheter output stopped during 24 hours, a follow-up sonography was performed. If an abscess cavity was absent, the catheter was removed. If a residual cavity was present, the catheter was flushed with normal saline and aspirated until the return was clear. Residual loculations of abscesses were treated with catheter repositioning and aspiration. Further sonography was performed three days later and the catheter was removed if it remained unproductive. Otherwise, the catheter was left in-situ until it stopped producing any content. Sonography was repeated every 3 days until the cavity either disappeared or showed a significant reduction along with a clinical recovery.

Needle aspiration

Complete evacuation of pus from each cavity was attempted with 18G disposable trocar needle (Boston Scientific). The needle tip was inserted into the abscess for a complete pus removal. Sonography was performed every 3 days and the size of the abscess was recorded. If there was neither any clinical improvement nor any reduction in the size of abscess cavity, the catheter for continuous drainage was introduced.

Statistical Analysis

Statistical analysis was done by using the MedCalc v. 8.0.statistical software. Quantitative variables were compared by using two-sample t-test for independent samples, whereas categorical variables were analyzed by Fisher's exact test. Statistical level of $p<0.05$ was considered as significant for all the performed tests.

Results

Liver abscess was diagnosed in 71 patients during the study period. There were 42 females and 29 males, with the average (± SD) age of 56.2±12.3 (range 17-76).

Prior to hospital admission patients had shown symptoms for a mean of 17.8 ± 15.2 days (range 1-52). Forty-one patients (57.7%) underwent surgical interventions in the abdomen before percutaneous treatment. The symptoms, signs and results of routine haematology and biochemistry tests upon admission are shown in Table 1.

Table 1. Main complaints and clinical findings, haematology and biochemistry tests on the day of admission in 71 patients with liver abscess

Test	Median (range)	Normal	Abnormal result n (%)
Fever	–	–	51 (72)
Abdominal pain	–	–	49 (69)
Night sweats	–	–	31 (44)
Weight loss	–	–	25 (35)
Hepatomegaly	–	–	23 (32)
Jaundice	–	–	14 (20)
ALT (U/l)	89 (12-390)	30-65	49 (69)
AST (U/l)	48 (19-345)	15-37	35 (49)
ALP (U/l)	373 (102-905)	50-136	47 (66)
Bilirubin (µmol/l)	15 (4-456)	0-17	26 (37)
White cell count (x109/l)	18.3 (6.5-32.9)	(5-8)	67 (94)
Neutrophilia (x109/l)	13.2 (4.6-31.3)	1.7-6.5	69 (97)

ALT: alanine aminotransferase; AST: aspartate aminotransferase; ALP: alkaline phosphatase

Twenty-three (35%) patients had a normal liver function on admission, while 9 patients (13%) had a normal white blood cell count.

A potential underlying disease for liver abscess was found in 59 out of 71 patients (83%). The spread of infection via the biliary tract was more frequent than via the portal venous system (Table 2).

In 14 patients with liver abscess the underlying disease was diagnosed as a result of investigations conducted after the identification of liver abscess.The following underlying diseases were found: inflammatory bowel disease in 5 patients (3 cases of Crohn´s disease, 2 of colitis), 5 patients with diverticulitis, 3 with gall-bladder cancer, and one patient with a track between peptic ulcer and liver abscess.

Table 2. Underlying pathology in 71 patients with pyogenic liver abscess

Cause	n (%)
Biliary	32 (45)
Status post cholecystectomiam	12 (17)
Deviscerated hydatid cyst	8(11)
Trauma	7 (10)
Biliary malignancy	5 (7)
Portal	27 (38)
Stomach surgery	9 (13)
Inflammatory bowel disease	7 (10)
Diverticulitis	6 (8)
Status post appendectomiam	5 (7)
Cryptogenic	12 (17)
Total	71 (100)

Frank pus was obtained from the abscesses in all 71 patients. A microbial pathogen was isolated in 54 patients (76%). The blood culture was positive in 14 out of 54 patients (26%) and abscess culture in 41 out of 54 patients (76%). All patients who tested positive in regard to blood and abscess culture had identical pathogens. More than one organism were isolated in 23.9% of patients with positive culture. More than one organism were identified only in pyogenic liver abscesses that were caused by infection originating in the intestinal tract (Table 3). All patients received the appropriate antibiotic therapy. Fourteen patients had the antibiotics therapy changed after pus culture and sensitivity test were obtained; the adjusted antibiotics therapy included Ceftazidime (n = 5), Imipenem (n = 5), and Klaritromycine (n = 4).

Forty patients (56%) with liver abscess had a single abscess; 31 (44%) had multiple abscesses. Abscess formation was in the right lobe in 42 patients (59%), while in 11 patients (16%) it was found in the left lobe. Abscess formation in both lobes was found in 18 patients (25%). The size of abscesses ranged from 32 to 112 mm, with a mean of

Table 3. Bacterial isolates in 54 patients with pyogenic iver abscess

Bacteria	n	Isolated from pus (n)
Gram-negative (total)	29	22
Escherichia coli	12	10
Pseudomonas species	4	3
Klebsiella pneumoniae	12	8
Morganella morgani	1	1
Gram-positive (total)	33	25
Streptococcus milleri	14	10
-Haemolytic *Streptococcus*	6	5
Enterococcus	8	7
Streptococcus pneumoniae	2	1
Staphylococcus aureus	3	2
Anaerobes	6	4
Bacteroides species	6	4
Total	67	51

68.8 ± 9.5 mm. Statistical analysis revealed that the presence of the underlying disease correlated neither with the size or number of abscesses, nor with age, gender, and species of microorganism.

Needle aspiration was performed in 35 patients (49.3%) as initial treatment. In 14 patients needle aspiration was a definitive and successful treatment. One patient died after PNA due to complications caused by biliary malignancy. After PNA treatment three patients were referred for surgery, two out of three with a favourable outcome while a third patient died after PNA treatment and a new surgery due to the recurrence of pancreas malignancy (Table 4). Seventeen out of 35 patients (48.6%) had a recurrence of abscess collection and required continuous percutaneous drainage; they were also administered antibiotics instilled through the catheter. In 13 patients PCD applied after PNA was a definitive and successful treatment although 4 patients in this specific group were transferred for surgery after PNA and PCD treatment.

In 36 patients (50.7%) with abscess collection greater than 50 mm in diameter percutaneous catheter drainage was initially performed (Table 4).

Table 4. Type of treatment and outcome in 71 patients with pyogenic liver abscess

Treatment method	*n*	Mean±SD hospital stay (days)	Death
PNA	15	10.6± 7.2	1
PNA/PCD	13	16.3± 9.1	–
PCDx1	23	26.5±12.2	–
PCDx2	12	34.6±12.8	1
PNA / Surgery	3	23.8±10.7	2
PCD / Surgery	1	27.9±16.8	–
PNA/PCD/Surgery	4	41.6±19.7	3
Total	71	24.1±14.3	7

PNA: percutaneous needle aspiration; PCD: percutaneous catheter drainage.

Twelve patients who had a persistent abscess cavity or poor drainage underwent percutaneous catheter drainage two times. PCD was a definitive and successful treatment for 37 patients; for 13 patients after PNA and PCD treatment while for 11 patients after two PCDs. One patient with percutaneous drainage died due to the recurrence of stomach malignancy while another was eventually referred for surgery, with a favourable outcome. The mean hospital stay (±SD) was 24.1 ± 14.3 days. The shortest hospital stay was in the group with PNA (Table 4). The mortality rate was 15.5 % (Table 4). All 7 deceased patients died of predisposing factors such as malignancy rather than of pyogenic liver abscess itself.

Discussion

Pyogenic liver abscess commonly develops secondary to biliary infections such as cholecystitis, cholangitis, infection of deviscerated liver hydatid cyst (14) or infection of organs that are drained by the portal vein (diverticulitis, appendicitis, inflamatory bowel disease) (15). While studies of patients with infection of organs that are drained by portal vein suggest an increased incidence of portal bacteremia, the development of

liver abscesses in these patients is relatively rare (15). In the majority of cases, more than one organism have been isolated from their abscesses (16). In our study more than one organism were identified only in pyogenic liver abscesses that were caused by infection originating in the intestinal tract.

In the past, antibiotic therapy and surgical drainage were considered the treatments of choice for liver abscesses. The recent trend in management of liver abscesses has increasingly been in favour of non-surgical methods. Several investigations (3-12) have shown that a significant proportion of patients can be treated with a combination of parenteral antibiotics and image-guided percutaneous treatment with excellent results, but a question whether to perform percutaneous catheter drainage or intermittent needle aspiration remains controversial.

Some authors reported their positive experience with PNA treatment as a safe and effective approach with recommendations that it should be considered a first-line treatment in the management of liver abscesses. A majority of abscesses required no more than two aspirations, irrespective of their size (10-13). The use of catheters is reserved for cases of rapid re-accumulation of exudate and for those without a general improvement of the patient's condition (17). The findings in other studies suggest that continuous catheter drainage is a reliable and effective approach to the treatment of liver abscesses (3, 18-24).

In comparison with surgery percutaneous treatment is significantly advantageous for several reasons: a) external drainage does not involve major risks in respect of intraabdominal spillage or risks related to administration of general anesthesia b) it is time and cost effective c) it ensures a better compliance and easier nursing care. This treatment is especially recommended for patients in a critical condition postoperatively, but also when the risks of administering general anesthesia or surgical drainage are substantial (7).

More than half of patients involved in our study had surgical interventions in the abdomen or retroperitoneum earlier, and as a result, PCD or PNA were the only available treatments for those patients. Percutaneous treatment was a successful and definitive treatment in almost all of our patients. All deceased patients died of the underlying malignant diseases.

We recommend PNA, primarily in the treatment of liver abscesses with the maximal diameter shorter than 50 mm, since our experience showed that PNA was sufficient to solve these abscesses in about 50% of cases. Also, this method is much simpler and less aggressive than PCD; PNA treatment involves a shorter hospital stay and lower costs. If PNA was insufficient, we subsequently applied the drainage technique using an 8-French pigtail catheters.

In patients with liver abscesses longer than or equal to 50 mm in the maximal diameter we initially introduced an 8-French catheter.When persistence of clinical signs was combined with a poor drainage, the correct location of the catheter had to be verified. The possibility of placing an additional catheter should always be explored if the abscess persisted.

Conclusion

In conclusion, ultrasound-guided percutaneous treatment of liver abscesses is a safe and effective alternative to surgery because it enables us to avoid perioperative complications, providing at the same time a better compliance and easier nursing care. We recommend PNA primarily in the treatment of liver abscesses smaller than 50 mm while PCD should be applied for those larger than 50 mm in the longest diameter. The results of our study, along with those from the previous ones, may contribute to finding a de-

finitive answer whether a first-line treatment for liver abscesses is percutaneous catheter drainage or intermittent needle aspiration.

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