Liver Abscess Caused by an Infected Ventriculoperitoneal Shunt

Meng-Chuan Shen, Susan Shin-Jung Lee, Yao-Shen Chen, Muh-Yong Yen, and Yung-Ching Liu

Abstract: Pyogenic liver abscess in Taiwan is most commonly due to Klebsiella pneumoniae infection in diabetic patients, and less frequently due to biliary tract infections. Liver abscess caused by ventriculoperitoneal (VP) shunt is very rare. We report a case of liver abscess caused by methicillin-resistant Staphylococcus aureus (MRSA), which developed as a complication of an infected VP shunt. A 53-year-old woman, who had shad a VP shunt implanted 3 months previously for hydrocephalus due to intracranial hemorrhage, presented with fever off and on, drowsiness and seizure attacks for 1 week. Computed tomography (CT) of the brain showed only mild right-sided hydrocephalus, and was negative for intracranial hemorrhage and intracranial mass. Analysis of cerebrospinal fluid showed significant pleocytosis and hypoglycorrachia. CT scan of the abdomen disclosed a huge abscess in the right lobe of the liver. Cultures of both the cerebrospinal fluid and aspirated liver abscess isolated MRSA. The patient was treated with intraventricular and intravenous vancomycin, intravenous teicoplanin and oral rifampicin, followed by oral chloramphenicol and rifampicin. Percutaneous drainage of the liver abscess and externalization of the VP shunt were performed. The liver abscess had resolved almost completely on ultrasonography after 2 weeks of therapy. Liver abscess in patients with a VP shunt should be considered a possible abdominal complication of the VP shunt, and may be caused by unusual pathogens. Diagnosis requires CT scan and direct aspiration and culture of the liver abscess. Treatment requires management of both the liver abscess and the infected shunt.

Key words: Liver abscess; Ventriculoperitoneal shunt; Staphylococcal infections; Prosthesis-related infections

Pyogenic liver abscess is an uncommon complication of intra-abdominal infection or biliary tract infection. It may be due to ascending infection from the gastrointestinal tract, hematogenous spread via the portal venous system or from a remote infectious focus, or spread of infection from contiguous structures. The pathogen is usually polymicrobial since the infection originates from the gastrointestinal tract. However, in Taiwan, the predominant pathogen causing liver abscess is Klebsiella pneumoniae, and occurs primarily in diabetic patients. Liver abscess as an abdominal complication of ventriculoperitoneal (VP) shunt is uncommon, and has only been infrequently described in case reports. We report a case of liver abscess due to methicillin-resistant Staphylococcus aureus (MRSA) that developed as a complication of an infected VP shunt.

Case Report

A 53-year-old woman had a 15-year history of hypertension, and had suffered from 2 episodes of intracranial hemorrhage over the right and left basal ganglia in November 1997 and May 2001, respectively. Hydrocephalus developed and VP shunt was implanted in May 2001. She was transferred to a local hospital for chronic care due to ventilator dependency, at which time her consciousness was clear and her body temperature was normal.

However, intermittent fever developed 1 week prior to admission, beginning in August 2001. An obvious source of infection could not be found and fever persisted despite empiric treatment with antibiotics. Frequent seizure attacks developed 3 days after admission and she was transferred to our hospital for further management.

On arrival at our emergency department, temperature was 39.5 °C, pulse rate was 120/min, respiratory rate was 30/min, and blood pressure was 160/91 mm Hg. She was drowsy, but could be aroused by external stimuli. Physical examination revealed mild abdominal tenderness over the right upper quadrant. Laboratory test results were as follows: white blood cell count 10.25 x 10^9/L, with 91% neutrophils;
Liver abscess was confirmed by the aspiration of creamy yellowish pus, and percutaneous transhepatic pigtail catheter drainage was performed. Gram stain of the CSF and pus from the liver abscess showed Gram-positive cocci in clusters, and both cultures isolated methicillin-resistant *Staphylococcus aureus* (MRSA). The peritoneal end of the VP shunt was externalized, and culture of the tip of the shunt also isolated MRSA. These isolates were all sensitive to both vancomycin and rifampicin. Intravenous vancomycin was given at a dose of 500 mg every 6 hours, in addition to intraventricular vancomycin 10 mg per day. The antibiotic was shifted to intravenous teicoplanin 400 mg per day, in combination with rifampicin 600 mg every 12 hours orally, due to drug fever and severe allergic skin reaction on hospital day 10. After 2 weeks of pigtail catheter drainage combined with antimicrobial treatment, ultrasonography of the liver revealed almost complete resolution of the liver abscess. Cultures of the CSF were sterile on hospital day 14 and 21. After a 3-week course of parenteral antimicrobial treatment, the antibiotic regimen was shifted to oral rifampicin and chloramphenicol due to recurrence of allergic skin reaction. Removal of the VP shunt was performed by a neurosurgeon to ensure eradication of shunt-related infection. The patient was discharged from our hospital after receiving tracheostomy and successful weaning from ventilator. During regular follow-up of 1 year’s duration at our outpatient department as part of an antihypertensive therapy and rehabilitation program, her general status was quite stable and her consciousness clear.

**Discussion**

Abdominal complications occur in approximately 15 to 25% of VP shunt systems. These problems include...
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peritonitis, ascites, hernia, perforated colon, perforated bladder, intestinal obstruction, abscess,10,11 acute appendicitis,20 and the most common complication, cerebrospinal fluid pseudocyst.11,21 The associated shunt infections suggested 2 potential modes of development: 1) descent of contaminated CSF from an infected shunt into the abdomen; and 2) ascent of bacteria into the shunt from an abdominal source. Descent of bacteria into the abdomen from an infected shunt was predominantly caused by Gram-positive, cutaneous micro-organisms, whereas those associated with ascent of bacteria from the abdomen into the shunt were mixed, Gram-negative intestinal micro-organisms.10

Hepatic abscess is an important but rare complication of the VP shunt, and our MEDLINE literature search found a limited number of case reports9,11-16,18

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<td>Meningomyelocele, hydrocephalus</td>
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<td>Fever, RUQ pain, emesis, lethargy</td>
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<td>Large hepatic abscess</td>
<td>Solitary liver abscess</td>
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<td>Solitary liver abscess, shunt tip in the abscess</td>
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<td>Exploratory laparotomy, externalization of shunt tube</td>
<td>Drainage of abscess, removal of VP shunt</td>
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Table). Among 8 cases with enough data available for review, 6 were adults and 2 were pediatric patients (one was 26 months old, the other was 4 months old). The male to female ratio was 3:5. The cause of VP shunt implantation included subarachnoid hemorrhage (4 adults), aqueductal stenosis (1 adult), pineal gland tumor (1 adult), and congenital anomalies of the central nervous system (2 pediatric patients). Fever was present in 7 patients, abdominal pain in 4, change of consciousness or headache in 3, and vomiting in 3. One patient presented with cough and right-sided pleuritic pain. Chest film was performed in 3 of the 8 patients, and right-sided pleural effusion was found in 2 patients and right lower lung infiltrate in 1 patient. Six of 8 (75%) patients had solitary liver abscess/cyst, and 2 of 8 (25%) had multiple liver abscesses on ultrasonography or CT scanning. CSF culture was

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**Fig. 2.** A) CT scan of the abdomen reveals the peritoneal tip of the VP shunt (arrow). B) A huge, well-defined, rounded, low-density lesion (arrow), 10 cm in diameter, was seen in the right lobe of the liver.
done in 5 patients and pathogens isolated included *Corynebacterium JK II* (1), *Staphylococcus epidermidis* (2), *Enterococcus faecalis* (1), and no growth (1). Culture of the liver abscess was done in 6 patients and isolated *Corynebacterium JK II* (1), *Staphylococcus albus* (1), *Enterococcus faecalis* (1), *Staphylococcus epidermidis* (1), *Escherichia coli* (1), and no growth (1). Drainage of the abscess was performed in 4 patients, externalization of shunt tube from the peritoneal end was done in 2 patients, and the VP shunt was removed in 5 patients. The outcome was satisfactory in all of these 8 patients.

Fever, change of consciousness, and mild abdominal pain were the most prominent symptoms in these cases, similar to the presentation in our patient. The most likely pathogenetic mechanisms are shunt-tip migration or direct liver penetration, with subsequent abscess formation. Ultrasond and computed tomographic scanning of the abdomen are valuable diagnostic imaging modalities, that should be included as routine examinations when patients with VP shunt develop shunt malfunction and/or fever. Aspiration and culture of abscess confirmed the diagnosis and the microbiologic etiology, and guided the appropriate antibiotic therapy. Treatment of a shunt-related liver abscess requires aggressive intravenous and intraventricular antibiotic therapy, shunt externalization or removal, and percutaneous transhepatic catheter drainage of the abscess.

Reported appropriate doses of intraventricular vancomycin have ranged from 5 to 20 mg per day. The adequacy of the CSF vancomycin concentrations or the titer of CSF bactericidal activity should be checked to determine the adequacy of treatment. A titer greater than 1:8 gives clinical results similar to those of an inhibitory quotient ≥ 10.

**References**