CASE REPORT

A new interventional technique for percutaneous treatment of drainage-resistant liver abscess

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ABSTRACT. The objective of this case report is to describe a device that can be used as a minimally invasive alternative for the treatment of drainage-resistant liver abscess. The device uses pulse lavage to fragment and evacuate the semi-solid contents of a liver abscess. The treatment of liver abscesses consists of percutaneous drainage, antibiotics and treatment of the underlying cause. This approach can be ineffective if the contents of the abscess cavity are not liquid, and in those cases open surgery is often needed. Here, we describe for the first time a new minimally invasive technique for treating persistent liver abscesses. A patient developed a liver abscess after a hepatico-jejunostomy performed as a palliative treatment for an unresectable pancreatic head carcinoma. Simple drainage by a percutaneously placed pig-tail catheter was insufficient because of inadequate removal of the contents of the abscess cavity. After dilatation of the drain tract the persistent semi-solid necrotic contents were fragmented by a pulsed lavage device, after which the abscess healed uneventfully. The application of pulsed lavage for debridement of drainage-resistant liver abscesses proved to be an effective and minimally invasive alternative to open surgery.

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The mainstays of the treatment of liver abscesses are drainage and antibiotics. Drainage can be performed by ultrasound- or CT-guided percutaneous drain placement or by surgical techniques using laparoscopy or laparotomy. The most appropriate method of drainage is controversial and varies from open surgery to repeated percutaneous punctures. Surgical drainage had a higher success rate and a shorter hospital stay than percutaneous drainage in a retrospective study of 80 patients with large pyogenic liver abscesses [1]. By contrast, a randomised trial revealed that drainage by repeated puncture was equally as effective as percutaneous drainage in which an indwelling catheter was left behind [2]. For most patients with liver abscesses, percutaneous drainage is an effective treatment.

In patients with highly viscid, sticky pus or infected necrotic tissue, it is much more difficult to clean the abscess cavity because of occlusion of the relatively narrow percutaneous drain and inability to remove the semi-solid contents. In these cases, surgery is performed to create a large opening and adequate drainage of the contents of the abscess cavity. Even partial liver resection has been advocated for the treatment of drainage-resistant liver abscesses [3].

Here, we describe a new technique that has the potential to treat a non-resolving liver abscess efficiently after simple percutaneous drainage. The technique uses pulsed lavage, which is able to fragment and evacuate non-liquefied debris in a liver abscess using a percutaneous approach.

Case report

A 69-year-old man with a history of triple coronary artery bypass grafting presented with a large duodenal carcinoma in the second part of the duodenum. No signs of distant metastases were found on pre-operative imaging and he was scheduled for a pancreaticoduodenectomy. Careful evaluation of the pre-operative CT scan during the arterial phase revealed no sign of an aberrant right hepatic artery, which would be important to reconstruct if present [4]. During surgery, extensive metastases were found in the lymph nodes around the celiac trunk and the patient was considered incurable. A double bypass (gastrojejunostomy and hepatico-jejunostomy) was performed. Subsequently, palliative treatment with capecitabine was started.

Four months later, the patient presented with cholangitis with dilated intrahepatic bile ducts, suggesting a stenosis. A percutaneous transhepatic cholangiography was performed and a pin-point stenosis was seen at the

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Figure 1. (a) CT scan image of the dome of the right liver lobe with abscess cavity containing some air and necrotic debris (arrow). (b) Semi 3D reconstruction of CT image showing abscess cavity (yellow arrowhead) and abscess drain passing through the intercostal space (blue arrow) with pig-tail (yellow arrow) at the bottom of the cavity. The sticky necrotic material (blue) in the abscess cavity is not evacuated through the drain.

site of the hepaticojejunostomy. An expandable stent was inserted via the percutaneous route, restoring the biliodigestive continuity. Afterwards, the patient continued his capecitabine therapy.

Five months later, the patient presented again with obstructive jaundice and fever. A stent occlusion was diagnosed. Several percutaneous procedures had to be performed to reopen the stent. The final and successful attempt was complicated by a severe arterial bleed from the right hepatic artery, for which transarterial coiling of the right hepatic artery had to be performed. Afterwards, a 7 cm large necrotic area was seen on CT scan, which was drained by a percutaneous route. A total of 100 ml of pus was obtained, from which *Escherichia coli* sensitive to imipenem was cultured. The abscess cavity was repeatedly rinsed with 10–20 ml of sterile saline, but despite this, the patient remained febrile and a repeat CT scan revealed that the abscess cavity was still filled with debris (Figure 1). He was then referred to our department for surgical drainage via laparotomy.

We decided to try to settle the problem by using pulsed lavage via a minimally invasive percutaneous approach. We used the Amplatz Renal Dilator Set (Cook Urological, Spencer, Indiana, USA) for dilatation of the drain tract and the Pulsavac Plus system (Zimmer Inc., Warsaw, Indiana, USA) for pulsed lavage. With the patient under general anaesthesia, a guide wire was inserted into the liver abscess through the percutaneous pig-tail drain that was already in place. The pig-tail was removed and the percutaneous tract dilated over the guide wire using the dilator set. A hollow tube (diameter 9 mm) from the dilator set was inserted via the dilated tract into the abscess cavity. The rinse/suction tube of the Pulsavac device was inserted via the hollow tube into the abscess cavity. Using the lowest

pressure setting of the device, the abscess was irrigated using sterile saline. Sticky, semi-solid necrotic material was easily removed after pulsed lavage (Figure 2). Using the cholangioscope, we inspected the cavity for remnant necrotic tissue and a Foley catheter was left in place for drainage purposes.

After the pulsed lavage, the fever subsided and the patient recovered uneventfully, except for a replacement of the drain because of inadvertent dislocation. Six weeks later, the drain was gradually withdrawn and the abscess cavity resolved.

Discussion

The diagnosis and treatment of liver abscesses tends to be straightforward. Percutaneous drainage, antibiotics and treatment of the possible cause of the abscess (e.g. biliary tract obstruction) are the cornerstones of treatment. A high success rate has been described both after repeated puncture drainage and after percutaneous drainage with temporary insertion of a drain [2]. Even in multiple or multiloculated abscesses, success rates of up to 90% have been reported [5]. The restraints to the diameter of the drain lumen or its side holes might be a limiting factor for adequate drainage. This is especially the case if the contents of the abscess are non-liquefied and sticky. In particular, in patients with secondarily infected, infarcted segments of the liver, evacuation of necrotic and infected tissue can sometimes be problematic [6]. In that situation, mechanical debridement using a pulsed lavage system might be helpful. The principle of pulsed lavage is to mechanically “dissolve” semi-solid, necrotic tissue by using an irrigating saline solution that is applied under a certain pressure. A helpful overview of

Figure 2. Intraoperative pictures showing Pulsavac device (a) and the withdrawal of infected necrotic sticky tissue (b), which could be easily removed after cleansing the abscess cavity with pulse lavage.

the principles, methods and physics of wound cleansing using pressure has been published by Luedtke-Hoffmann and Schafer [7]. For superficial wounds, the type of fluid used does not seem to be relevant [8], but we consider sterile saline to be the most suitable solution for the treatment of liver abscesses. In this patient, we used the Pulsavac Plus system, which is used by orthopaedic surgeons to irrigate joints and by abdominal surgeons to clear pancreatic necrosis in patients with pancreatitis. It generates a pulsatile water jet and, by concurrent irrigation and suction, it cleans the operation field without flooding it.

A possible disadvantage of the irrigation of a closed cavity with pressure is the initiation of bacteraemia. The precautions to prevent this are the use of low pressure systems and the application of continuous suction during the pressurised rinsing. In a summary of the experiments performed in animals and humans, the risk of bacterial seeding in the bloodstream seems to be negligible [7].

To conclude, in those rare cases in which percutaneously placed (pig-tail) drains are not able to evacuate sticky, necrotic material from an abscess cavity in the liver, the use of pulsed lavage via the minimally invasive, percutaneous route should be considered as an effective alternative to maximally invasive open-surgical drainage. To the best of our knowledge, this is the first presentation of a successful treatment of a liver abscess using pulsed lavage.

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