

# Intra-Abscess Administration of Antibiotics Through Ultrasound-Guided Percutaneous Catheter for the Treatment of Pyogenic Liver Abscess

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## ABSTRACT

Pyogenic liver abscess is a potentially life-threatening disease. The treatment of a pyogenic liver abscess usually involves ultrasound guided percutaneous drainage because of the poor penetration of the systemic administration of antibiotics inside the abscess. However, a sizable proportion of patients will necessitate surgical interventions, which involves high peri- and post-operative risks. Theoretically, the local instillation of antibiotics inside the pyogenic liver abscess fluid could achieve a high concentration of the antibiotic for a long period of time. This could be especially beneficial for time-dependent bactericidal antibiotics such as beta-lactams, because their bactericidal effectiveness depends on the amount of time that bacteria are exposed to the antibiotic. We are reporting two patients with complicated pyogenic liver abscesses, who were successfully treated with systemic antibiotics and local instillation of meropenem inside the cavities of the abscesses. These cases suggest that the local instillation of the beta-lactam antibiotics could be an effective and a safe strategy for the treatment of pyogenic liver abscesses that cannot be completely drained through an ultrasound guided percutaneous catheter.

**Key words:** Hepatic abscess, Meropenem, Anti-bacterial agents, Minimal inhibitory concentration, Half life; Beta-lactam antibiotics, Safety, Effectiveness, Interventional radiology

## INTRODUCTION

Untreated, pyogenic liver abscesses tend to rupture into the peritoneum or pleura, and they are uniformly lethal [1]. Abscesses that are < 3-5 cm in diameter can be treated with systemic antibiotics alone, but larger abscesses require percutaneous drainage [2]. However, an important proportion of patients will necessitate surgical interventions, which involve high peri- and post-operative risks, especially for very sick patients and for abscesses that are situated in difficult-to-access locations.

The failure of systemic antibiotics in treating large abscesses can be explained by the poor penetration of antibiotics in the abscess fluid [2]. The concentration of the antimicrobial is inversely proportional to the distance to the centre of the abscess [2]. Therefore, reducing the volume of the abscess by a percutaneous or a surgical drainage allows the systemic antibiotic therapy to be effective. Theoretically, the instillation of the antibiotic into the abscess could provide high concentrations of the antimicrobial in the abscess fluid. Moreover, the lack of vascularization and the high concentration of proteins in the abscess fluid increase the half-life of the antibiotic inside the abscess [2]. This can be particularly beneficial for time-dependent bactericidal antibiotics such as beta-lactams, because their bactericidal effectiveness depends on the amount of time that the bacteria are exposed to the antibiotic. Although intra-abscess antibiotic treatment has been successfully used for the treatment of breast abscesses, [3] its use in the treatment of pyogenic liver abscesses has not been previously reported. Here, we are describing two cases with complicated pyogenic liver abscesses, that were successfully treated with local instillation of meropenem.

## CASE REPORT

The first case was an HIV infected, 42 years old man who presented to our hospital on September 25<sup>th</sup> 2012 with the complaints of pain in the abdomen, vomiting and fever for four days. The abdominal ultrasound showed two well defined heterogeneously hypoechoic

lesions next to each other in the segments IVb and V of the liver, which measured 5 and 5.4 cm respectively. Ceftriaxone and metronidazole were started empirically. On October 11<sup>th</sup> 2012, a needle aspiration of the abscess in segment V obtained 10 ml of pus. Despite the antibiotic treatment, the patient was still complaining of pain, the abscesses were increasing in size up to 7 cm in diameter and the one in segment IVb was expanding towards the capsule of the liver. On October 29<sup>th</sup> 2012, a 12 French catheter was placed in the abscess that was located in the segment IVb. Despite lavages with normal saline, only 30 ml of thick pus was drained, when the approximate volume of a 7 cm diameter sphere was 180 ml. The culture yielded a glucose non-fermenting gram negative rod that was sensitive to amikacin, ciprofloxacin and meropenem. Intravenous meropenem was started and 500 mg of meropenem, followed by 10 ml of normal saline, was administered inside the abscess. For connecting the external tip of the catheter and the syringe, we used a nasogastric or a suction tube that was cut near the wide tip. Then, the wide tip of the tube was connected to the external tip of the catheter and the narrow tip was connected to the syringe. The intra-abscess administration of meropenem was repeated two more times after one and two weeks since the first administration. The patient improved clinically and the sizes of the abscesses were reduced progressively. On November 26<sup>th</sup> 2012, the patient was discharged with oral ciprofloxacin for two weeks with normal liver function tests. Two weeks after stopping oral ciprofloxacin, the patient remained asymptomatic and the sizes of both abscesses were <2 cm in diameter.

The second case was an HIV infected, 30 years old man who presented to our hospital on September 17<sup>th</sup> 2012 with the complaint of intermittent fever for one month. The abdominal ultrasound showed a well defined, heterogeneously hypoechoic lesion in segment V of the liver, which measured 4.9 cm. Amoxicillin and clavulanic acid were started empirically. The blood culture yielded *Enterococcus faecalis* and *Proteus vulgaris* and the systemic antibiotic treatment was changed to ciprofloxacin and

gentamicin according to the antibiogram. The fever subsided, but the patient complained of right hypochondrium pain and the radiological controls showed a progressive enlargement of the abscess. On November 7<sup>th</sup> 2012, when the diameter of the abscess was 8 cm, a 12 French catheter was placed in the abscess. Despite lavages with normal saline, only 17 ml of thick pus was drained, when the approximate volume of an 8 cm diameter sphere was 268 ml. Five hundred mg of meropenem was administered inside the abscess, as has been described above and this procedure was repeated after one week. The size of the abscess experienced a rapid reduction and the patient was discharged on November 15<sup>th</sup> 2012 with oral ciprofloxacin for one week. On December 17<sup>th</sup> 2012, the patient remained asymptomatic, the liver function tests were normal and the abdominal ultrasound showed a 1.8 cm diameter residual cavity.

Written informed consents were obtained from the patients for the publication of this report.

## DISCUSSION

Despite the unsuccessful drainage of the pus, the systemic and the local antibiotic treatments were able to resolve these two cases of complicated liver abscesses without the need of surgical interventions. Both patients tolerated the intra-abscess administration of meropenem very well and we did not observe a rise in the liver enzymes after the local instillation.

The efficacy of antibiotic instillation inside an abscess depends on multiple factors such as the correlation between the antibiotic concentration in the abscess fluid and the susceptibility of the bacteria to the antibiotic, the half-life of the antibiotic in the abscess fluid and the antibiotic activity under anaerobic or acidic conditions [2]. The instillation of 500 mg of meropenem inside an abscess can achieve concentrations that are well above the minimal inhibitory concentration (MIC) for most clinically important bacteria [4–6]. The half-life of the antibiotic inside the abscess or, more important for time-dependant antibiotics, the amount of time above the MIC will depend on the impermeability of the abscess membrane, the metabolism of the antibiotic by the hepatocytes and the protein

binding capacity of the antibiotic. Although meropenem is mainly eliminated through the kidneys, it has a very low protein binding capacity. Thus, its half-life inside the abscess may be lower than that of other antibiotics. However, the low protein binding capacity of meropenem may allow high concentrations of the antibiotic in the tissue that surrounds the abscess. When two abscesses are very near each other, as in our first case, the diffusion of the antibiotic through the inter-abscess membrane may have allowed the concentrations of meropenem to be above the MIC in the second abscess as well.

## CONCLUSION

Local administration of antibiotics in the patients who have an intra-abscess catheter is easy to perform and these two cases suggest that it can be an effective and a safe treatment for pyogenic liver abscesses.

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