



## Case report

# A novel method for treatment of pseudomonas pyogenic hepatic abscess complicating an echinococcal cyst by irrigation with acetic acid. A case report and literature review



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## ABSTRACT

Hepatic hydatid cysts can be complicated by pyogenic abscesses. We report a case of hepatic hydatid cysts presenting to Sultan Qaboos University Hospital (SQUH) on 29 June 2010 complicated by secondary infection with fully sensitive *Pseudomonas aeruginosa*. The infection persisted despite standard treatment (drainage and systemic antibiotics) and was eventually cured with a novel method using acetic acid.

**Methods:** Instillation of acetic acid (in the form of white vinegar) into the hepatic abscess through the pig tail drainage tube.

**Results:** The administration of acetic acid (6%) in the form of white vinegar was well tolerated and safe to the patient and resulted in complete clinical and radiographic resolution of the hepatic abscess.

**Conclusion:** Acetic acid (vinegar) irrigation can be used to clear a refractory pyogenic hepatic abscess due to *P aeruginosa* infection.

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## Introduction

Human hydatid disease caused by *Echinococcus granulosus* is a zoonotic infection that is highly endemic in South America, China, Africa, and Mediterranean countries [1].

Treatment of hepatic hydatid disease is with albendazole and either cystectomy or puncture aspiration, injection, re-aspiration (PAIR) procedure [2,3].

Secondary infection of the *Echinococcus* cyst by various bacteria and fungi is a common complication of hydatid disease and the standard treatment of such infections is with systemic antibiotics and drainage [4–7].

Here, we report a case of hepatic hydatid cysts that were treated with PAIR procedure and albendazole but complicated by superimposed pyogenic abscess due to *P aeruginosa*. This infection persisted despite appropriate antibiotics and percutaneous drainage. It was finally treated with a novel method using irrigation of the abscess with acetic acid in the form of white vinegar through the drainage tube.

## Case report

A 40-year-old previously healthy lady from Bahla in Oman was referred to Sultan Qaboos University Hospital on 29 June 2010 from a private hospital with a six months history of right upper quadrant (RUQ) pain and intermittent undocumented fevers and an abdominal CT scan showing a large liver cyst. There was no history of travel, consumption of undercooked meat or raw dairy products and no animal contact. Examination revealed pain and tenderness in the RUQ and temperature of 37.9°C. Her laboratory results were unremarkable. An MRI Liver done at our hospital showed two well defined lobulated lesions in the liver measuring 13 × 7.7 × 10.8 and 4.7 × 3.8 cm located in segment 4 predominantly with extension to other lobes (right cyst) and in segment 2 (left cyst) respectively. Both lesions were hypo-intense on T1 and hyper-intense on T2, had a capsule with post contrast enhancement and neither had septations. The MRI features were suggestive of hydatid cyst. See Fig. 1.

This was supported by *Echinococcus* serology done by ELISA test (Cellognost, Siemens) that was strongly positive at a titer of 4096.

She was started on albendazole 400 mg bid, underwent US guided PAIR procedure of the left cyst (320 mL of fluid was aspirated, hypertonic saline 20 % injected into the cyst, left for 15

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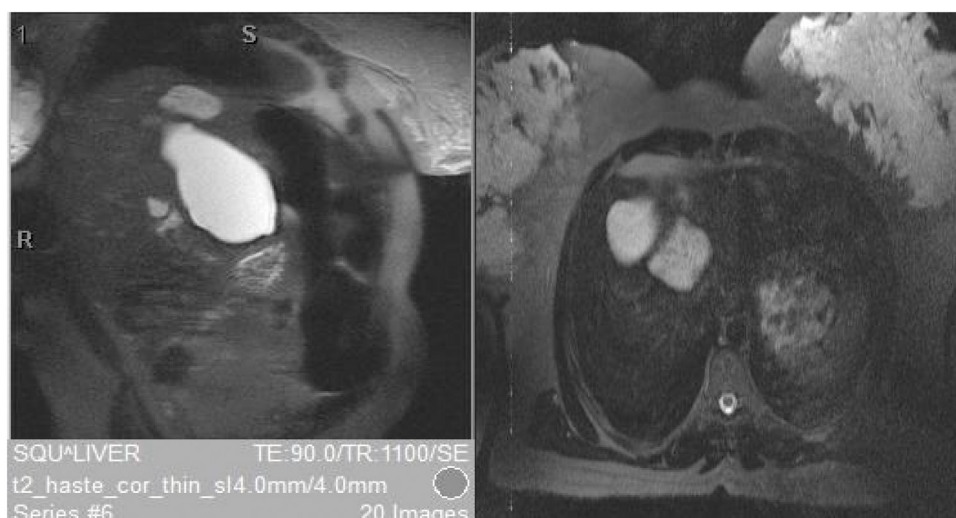


Fig. 1. a and b. MRI (T2 images) of liver showing 2 cysts in segments 2 and 4.



Fig. 2. CT scan post PAIR showing 2 cysts, one with detached membranes.



Fig. 3. CT scan showing marginal increase in both the size of cysts.

min then aspirated. Finally, 100 mL of 99% alcohol was infused into the cyst and left for 20 min before aspiration). The procedure was done in the radiology department by intervention radiologist under aseptic conditions. Cefuroxime was started post PAIR in response to a spike of fever. Aspirated fluid showed scolices of hydatid cyst further confirming the diagnosis of hydatid disease.

Post PAIR CT showed significant decrease in size of the cyst with multiple pockets of gas and membrane detachment was seen. See Fig. 2.

She was discharged on day 14 (of admission) on albendazole for 28 days and cefuroxime for 7 days and with a drain in situ with frequent follow ups. The drain was removed 6 weeks post PAIR.

A CT scan done approximately 4 month post PAIR showed marginal increase in the size of the hepatic cysts.  $3.8 \times 6.8$  cm from  $3.5 \times 6.5$  cm of the left cyst and  $6.7 \times 5.7$  cm from  $5.6 \times 4.3$  cm of the right cyst. See Fig. 3. The patient was readmitted and had PAIR of second cyst (segments 4/8). This drained thick yellow pus although samples sent to microbiology laboratory showed no growth. Pus thickness required frequent flushing of the draining tube with saline.

The patient was discharged on day 8 of admission, with the drain and on albendazole and moxifloxacin with regular follow ups. One week later the drain had 50 mL of fluid that grew

*Pseudomonas aeruginosa* despite her being discharged on moxifloxacin. Her *Echinococcus* serology here was  $< 16$ . Albendazole was, therefore, stopped and moxifloxacin was changed to ciprofloxacin 500 mg b.i.d for 3 weeks. This second drain was removed one-month post insertion after cessation of any drainage.

Six weeks post removal of drain 2, she presented with pus discharge from both previous drain sites and burning pain at the site disturbing her sleep. An urgent CT showed decrease in the size of both cysts ( $3.6 \times 4.3$  cm from  $3.7 \times 4.5$  cm in the left cyst and  $3 \times 2.5$  cm, from  $6.8 \times 5$  cm in the right cyst). The left cyst had tracts connecting it to the abdominal wall. She was therefore, admitted on 29/1/2011 and treated with Tazocin 4.5 mg t.i.d plus iv ciprofloxacin 400 mg b.i.d. The residual fluid was not drainable as advised by the intervention radiologist. Abdominal US done 14 days after this admission showed small residual debris in the cavity and the patient was discharged on ciprofloxacin 750 b.i.d after 2 weeks of iv antibiotics in hospital.

A Follow up CT abdomen done at 1 and 2 month after last admission showed unchanged size of lesion in the right lobe of the liver and significant decrease in the size of the left lesion. Ciprofloxacin was stopped 2 months after last admission.

Five months post last follow up, the patient attended the OPD with 7 days of RUQ pain on deep breathing, coughing or sneezing and on lying on R side. An urgent CT showed a sub-diaphragmatic collection measuring  $8.6 \times 7.5$  cm and an adjacent smaller collection of  $3.3 \times 2.3$  cm with a subcutaneous sinus tract. See figure

Ultra sound guided aspiration was done by intervention radiologist under aseptic technique and 60 mL of pus aspirated. Tazocin 4.5 mm t.i.d was started after sample collection. Pus grew *P. aeruginosa* (sensitive to ciprofloxacin and Tazocin). No scolices were seen in the fluid and the Echinococcus serology was  $< 16$ . A follow up US one week later showed reduction in the size of the collections ( $3.6 \times 3$  cm from  $8.7 \times 7.5$  cm and  $2 \times 1.4$  cm from  $3.3 \times 2.3$  cm). However, the drain continued draining 100–150 ml of pus daily for 5 weeks. The draining tube required flushing with sterile saline due to the stickiness of the pus. Due to the prolonged stay in hospital, the patient started to feel physically and psychologically exhausted and was longing for discharge especially that the month of Ramadhan (a holy month of fasting) was approaching.

After thorough review of her condition, we discussed with the patient the option of using of acetic acid in the form of white vinegar to irrigate the abscess due to failure of the conventional standard treatment of the abscess with drainage and appropriate antibiotics. We clearly explained that although vinegar had been used on skin wounds, it had not been used on visceral abscesses before.

Following obtaining consent from the patient, twenty ml of white vinegar was instilled into the draining tube and withdrawn several times. This was not associated with any pain. Thick pus and debris drained out and the patient was monitored overnight for any complications. Over the next few days the drain produced debris and 10–15 mL of serosanguinous fluid that eventually became zero. After 2 days of zero discharge (6 weeks post admission), the drain was removed and the patient was discharged on ciprofloxacin 750 b.i.d for another month.

Subsequent images done at 1 (US), 4 (CT), 8 (US), 20 (US), and 32 (US) months from last date of discharge showed normal liver with no collections. See Fig. 4. The patient remained well and asymptomatic.

## Discussion

Hydatid cyst disease is a common worldwide zoonosis [1]. In Oman it is considered as one of the endemic zoonotic diseases with abattoirs being the main source of infection. A sero-epidemiological study in six municipal abattoirs revealed a 14.6 % positivity of the livestock including camels, cattle, sheep and goats [8]. Humans usually acquire the infection by consumption of contaminated soil, water or food contaminated with infected canine faecal matter.

Dogs (definite host) in turn acquire it by eating offal of infected sheep (intermediate host). Our patient was a previously healthy house wife with no contact with animals. However, consumption of food or water contaminated with Echinococcus eggs could not be entirely excluded.

Hydatid cysts can be complicated by rupture, relapse or pyogenic infections with various pathogens [4–6]. Our patient did not show any signs of rupture or hydatid relapse as her serology had dropped to  $< 16$  and there were no scolices seen in the aspirated fluid after the initial presentation.

She, however, developed a secondary pyogenic infection caused by fully sensitive *Pseudomonas aeruginosa* that proved very difficult to eradicate. Possible sources of the secondary infection include introduction of the bacteria during PAIR procedure, during frequent flushing of the blocked tube or spontaneous. Hypertonic saline (20 %) used in PAIR does not support growth of *P aeruginosa* [9]. Moreover, the risk of infection of hydatid cyst post PAIR is considered to be low [10]. Frequent flushing of the draining tube afterwards with normal saline could have been the culprit as *Pseudomonas* is known to colonize fluids. This possibility is supported by the fact that the initial fluid at drainage of cyst 2 was negative and became positive at a later date after frequent flushing. The infection, however, could have risen de novo as reported in other cases [11,12].

Irrespective of the source of the secondary pyogenic infection, our patient received adequate conventional standard treatment for the hepatic abscess—consisting of percutaneous drainage and systemic antibiotics for sufficient duration on more than one occasion. Nevertheless, her problem persisted for 2 years.

Persistence and relapse of the bacterial infection despite the appropriate therapy (drainage and systemic antibiotics) was most probably facilitated by the formation of biofilms by the *Pseudomonas* which is known to form biofilms [13–15].

Biofilms comprise bacteria embedded within slimy extracellular matrix composed of polysaccharides, proteins and lipids produced by the bacteria themselves for protection [18]. Microorganisms form biofilms in response to various factors including recognition of attachment sites on surfaces, or exposure of planktonic organisms to sub-inhibitory concentrations of antibiotics [16,17]. Since our patient received adequate doses of dual antipseudomonal antibiotics (ciprofloxacin and Tazocin) for adequate duration, it is unlikely that sub-therapeutic treatment was the trigger. Instead, biofilms could have been triggered by adherence of the bacteria to residual inactive hydatid cyst.

Antibiotics that are effective against bacteria in vitro may be effective against planktonic bacteria in vivo but not so against bacterial colonies embedded within biofilms. This could well explain the failure of treatment in our case despite the use of appropriate antibiotics against *P aeruginosa*. Treatment of bacterial infections in biofilms is very challenging indeed. Electrical energy and ultrasonics have been investigated as options to eradicate biofilm infection [18,19].

We considered the use of acetic acid in this case due to the many reported medicinal uses for acetic acid including injection into tumors since 1800s, antiseptic properties when used as 1% against *Staphylococci*, *Streptococci*, *Pseudomonas*, *Enterococci* and in treatment of otitis externa. Its wound cleaning properties have also been noted by various cultures and for *Pseudomonas* infections [20–22]. Moreover, there have been reports on its effectiveness in breaking biofilms [23,24].

White vinegar is 4–7 % acetic acid and 93–96 % water. Traditionally it was made by fermentation of foods such as sugar and potatoes but nowadays by fermentation of ethanol by addition of yeast or phosphate. It is widely used in cleaning and widely available, being cheap and easily made. Moreover, table vinegar has been used to dress wounds [25].



Fig. 4. CT scan showing a large sub-diaphragmatic abscess plus another smaller collection.

Vinegar used in this case was freshly opened home vinegar. Its sterility was not tested as vinegar is widely known for its anti-septic properties.

We feared induction of pain or burning sensation during vinegar instillation but were reassured by the patient denying any discomfort and reporting only sensation of cold at site of irrigation.

The effectiveness of vinegar in eradication of the infection in this case was proved by the complete resolution of the infection clinically and radiologically over 8 years of follow up.

## Conclusion

Acetic acid (vinegar) irrigation can be used to clear a refractory pyogenic hepatic abscess due to *Pseudomonas aeruginosa* infection.

We, hence, report the first case of treating *Pseudomonas aeruginosa* hepatic abscess complicating hydatid cyst with acetic acid instillation and suggest that further studies should be conducted on this method to make it more widely used in similar cases and possibly in central line lock therapies for removing biofilms.

We call the method of instillation of vinegar (acetic acid) into abscesses Hassan Procedure.

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No funding is required.

## Author contribution

This manuscript was written by only one author, Kowthar Salman Hassan.

## Declaration

The patient and her next of kin gave consent at time of procedure. Consent for publication of the case was obtained from the patient over the phone at a much later date.

## Declaration of Competing Interest

The authors report no declarations of interest.

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