CME Article

Management of pyogenic liver abscesses – percutaneous or open drainage?

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ABSTRACT

This pictorial essay aims to review the literature on the management of pyogenic liver abscess, focusing on the choice of drainage. Articles on the treatment of pyogenic liver abscess, accessed through a MEDLINE search using PubMed, were reviewed. A case series of the authors' experience with clinicopathological correlation is presented to highlight the indication and outcome of each modality of drainage. Intravenous antibiotic is the first line, and mainstay, of treatment. Drainage is necessary for large abscesses, equal to or larger than 5 cm in size, to facilitate resolution. While percutaneous drainage is appropriate as first-line surgical treatment in most cases, open surgical drainage is prudent in cases of rupture, multiloculation, associated biliary or intra-abdominal pathology. Percutaneous drainage may help to optimise clinical condition prior to surgery. Laparoscopic drainage is a feasible surgical option with promising results in the future. Liver resection is reserved for concomitant localised intrahepatic disease and tumour, after control of sepsis. The final verdict on the outcome of percutaneous versus open surgical drainage of pyogenic liver abscesses requires further studies in a controlled trial setting. Nevertheless, in current good clinical practices, the choice of therapy needs to be individualised according to patient's clinical status and abscess factors. They are complementary in the management of liver abscesses.

Keywords: interventional radiography, laparoscopy, percutaneous drainage, pyogenic liver abscess, surgery

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Fig. 1 A 69-year-old man, with multiple previous hepatobiliary surgeries, was admitted in septic shock. Axial CT image shows a 9 cm × 7 cm × 7 cm carbuncle in the anterior right lobe. He responded to intravenous antibiotics and critical care support. Decision was made to continue with intravenous antibiotics at outpatient for six weeks, as percutaneous intervention would not have helped to decrease its size. Repeat CT then showed complete resolution. Appropriate systemic antibiotics alone can be used to treat large liver abscesses, albeit for a longer duration, if patient shows signs of improvement under close monitoring.

INTRODUCTION

Pyogenic liver abscess is a potentially fatal disease. Over the decades, there has been significant improvement in its mortality. This has been attributed to the introduction of antibiotics, advances in imaging studies and critical care. There has also been a paradigm shift in the treatment modality of choice from the traditional open surgery to the minimally-invasive percutaneous drainage. However, whether this has lowered the mortality rate is debatable. The treatment of choice remains controversial. The spectrum of treatment options ranges from sole medical therapy to the more complex liver resection. This update hopes to review the evidence pertaining to treatment of liver abscess and shed light onto this vexing question.

METHODS

A MEDLINE search of the English literature using PubMed was carried out, with the focus centred on the

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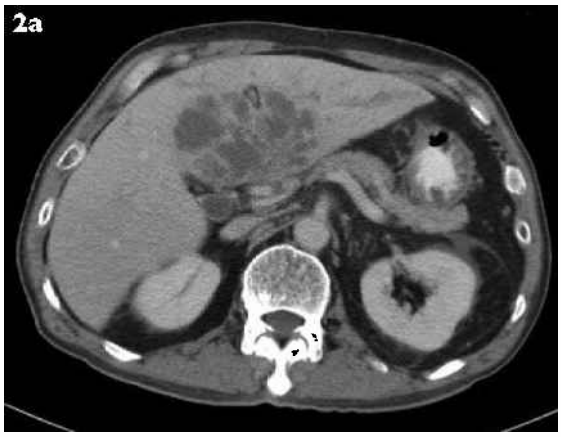


Fig. 2 A 76-year-old man presented with cholangitis. (a) Axial CT image shows an 8 cm × 5 cm × 8 cm multiloculated abscess at the left lobe with proximal biliary dilatation. He refused surgery and had percutaneous catheter drainage with resolution of sepsis. (b) Repeat axial CT image showed a smaller cavity complicated by subcapsular haematoma. He stayed a total of 12 days and went home without the catheter.

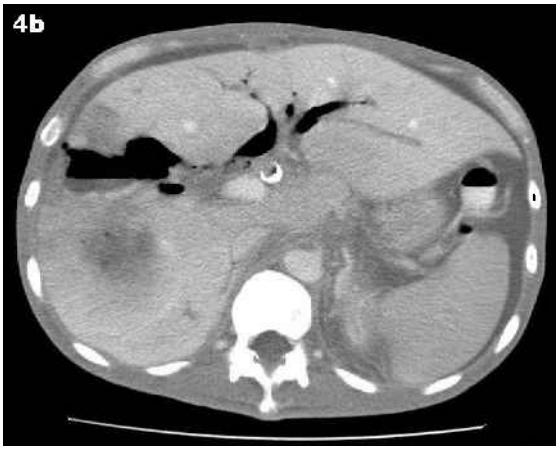


Fig. 4 A 48-year-old man who had recent colectomy and biliary stent for metastatic carcinoma colon was admitted in sepsis. (a) Axial CT image shows a large right lobe hepatic abscess with air-fluid level. (b) More distal axial CT image shows possible biliary communication with sludge in the metallic stent. Percutaneous catheter drainage was undertaken, followed by endoscopical clearing of the partially-blocked stent. Patient improved but succumbed to metastatic disease two months later. Concomitant malignancy is associated with poor outcome. Percutaneous drainage minimises the surgical insult in these otherwise compromised patients.

Fig. 3 Axial CT image shows a unilocular abscess with a thick oedematous rim in a 50-year-old man with fever and history of frequent overseas travel in the Southeast Asian region. The amoebic antibody titre was positive > 1/256. Percutaneous catheter drainage was performed for prolonged fever while he was on appropriate antibiotics. This led to prompt resolution and the catheter was removed after five days. Amoebic abscess is rare locally, but superimposed pyogenic infection requires broad-spectrum antibiotics and drainage.

treatment of pyogenic liver abscess. Where available, reports on prospective randomised comparative trials would be desirable. Unfortunately, due to lack of such data, the authors reviewed large retrospective comparative studies relevant to the topic. A case series of the authors' experience with clinicopathological correlation is also presented to highlight the indication and outcome of each modality of drainage.

ANTIBIOTICS

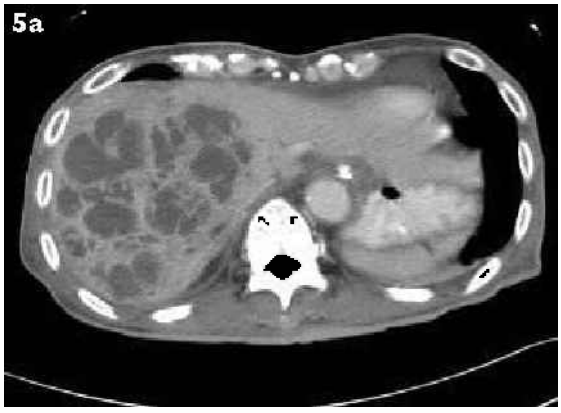
Systemic antibiotic therapy is the mainstay of treatment (Fig. 1). It must be targeted according to locally prevalent organisms and to specimen culture sensitivity. However, it should not be the only therapeutic modality, especially in abscesses ≥ 5 cm in size. In Bamberger's review, there was only 61% response rate in these pyogenic liver abscesses

Table I. Large retrospective comparative studies (≥ 80 patients) of treatment for liver abscess, in ascending chronological period of study.

	Study period	Number of patients	Mortality by treatment (%)			Failure of percutaneous treatment (%)
			Antibiotic alone	Percutaneous drainage	Surgery	
Chou et al, 1994[7] (Taiwan)	1986–1992	352	19.6	20.8	17.9	19.2
Huang et al, 1996[11] (USA)	1952–1972 1973–1993	80 153	100 –	– 26	20 14	not reported
Chu et al, 1996[8] (Hong Kong)	1984–1995	83	41.7	4.5	29.6*	11.3
Seeto and Rockey, 1996[9] (USA)	1979–1994	142	25	6.1	13	PNA 24 PCD 10
Barakate, 1999[10] (Australia)	1987–1997	89	15.4	6.3	9.5	19
Tan et al, 2005[3] (Singapore)	2000–2002	80	-	2.8	4.6	27.8

Differences are not statistically significant

* In the 27 patients who underwent surgery, 16 (59%) have additional hepatobiliary procedures other than cholecystectomy. All surgical deaths (eight) had emergency surgery, and three of these were for failed percutaneous procedures.



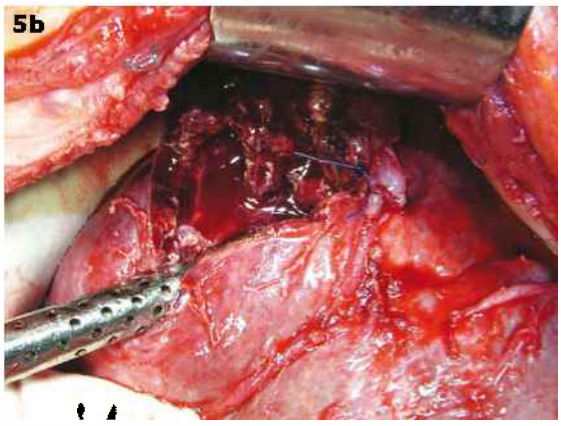


Fig. 5 A 64-year-old man with diabetes mellitus was admitted with herpes zoster and in septic shock. (a) Axial CT image shows a 12 cm × 10 cm × 9 cm multiloculated abscess in the right lobe. There was associated dilated common bile duct with calculi and gallstones. At surgery, the cavity was deroofed and all the locules broken down. (b) Operative photograph shows that the metal suction apparatus was effective in clearing the debris in the cavity. Cholecystectomy and extraction of the bile duct stones with insertion of T-tube was also done.

when antibiotics alone were used and the median antibiotic duration was long (42 days).[1] Therapy ≤ four weeks was a significant predictor of failure, requiring subsequent intervention. The mortality in retrospective comparative studies was high (Table I). Locally, the prevalent offending organism was *Klebsiella pneumoniae*.[2,3]

DRAINAGE

Large pyogenic abscesses usually need drainage, in addition to antibiotics for effective resolution.[1] Medical therapy alone does not work, because of large bacterial load, inactivation of antibiotics and ineffective medium for bacterial elimination. The duration of antibiotic therapy may be shortened with effective drainage.[4] There are currently two methods for drainage, namely: nonsurgical (percutaneous needle aspiration [PNA] or percutaneous catheter drainage [PCD]) and surgical (open [OD] or laparoscopic drainage [LD]).

Percutaneous drainage

Percutaneous drainage requires local anaesthesia and minimal sedation. This is best performed with transabdominal ultrasonography and fluoroscopy in radiology suites or operating theatres under aseptic conditions. PNA is advantageous in allowing smaller and multiple lesions to be sampled for culture and to obviate the need for catheter placement, which may be difficult under certain circumstances. The earlier randomised study by Rajak et al showed a lower success rate of only 60% (limited to two aspirations), compared to 100% successful

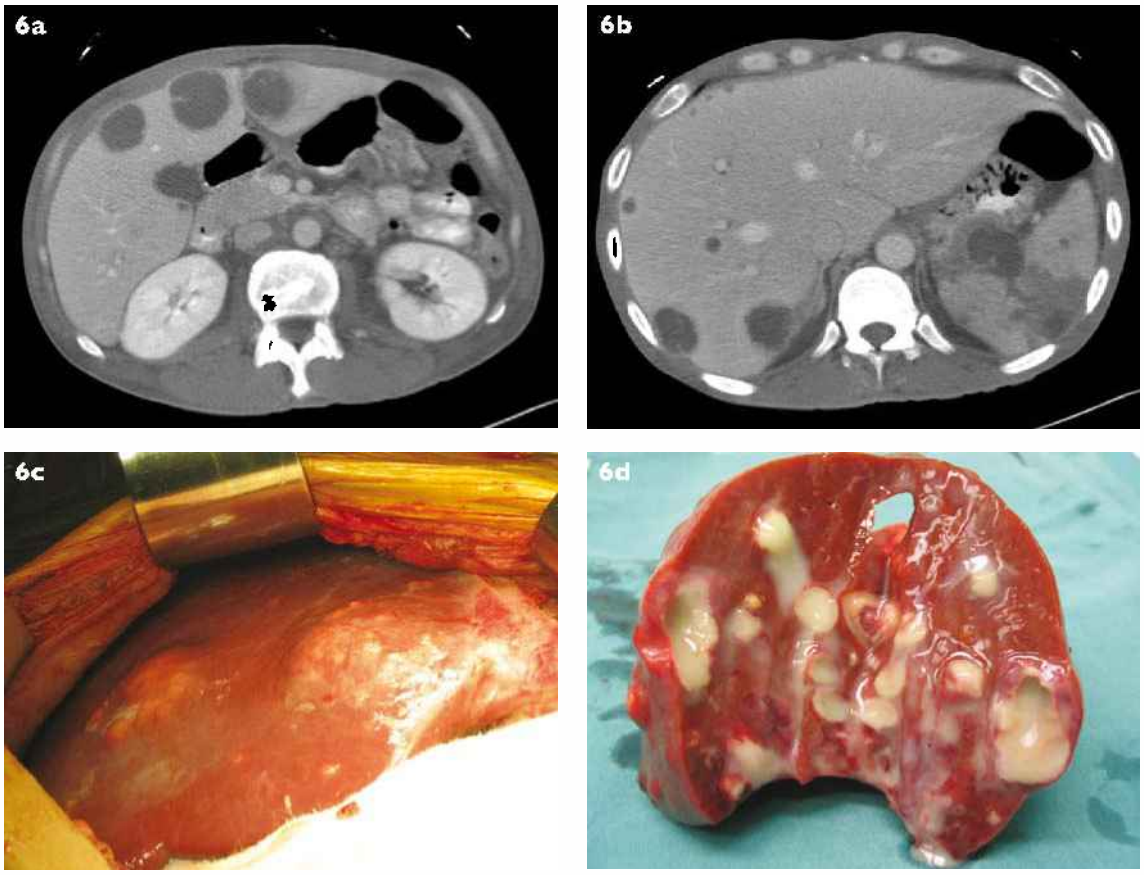


Fig. 6 A 46-year-old man, known to have diabetes mellitus, had intermittent fever and upper abdominal pain for a month. (a) Initial axial CT image shows multiple liver and splenic abscesses compatible with *Burkholderia pseudomallei* sepsis. (b) Interval axial CT image shows increasing size of the liver abscesses and ruptured splenic abscess with clinical deterioration, despite appropriate antibiotics. (c) Operative photograph shows these abscesses to the right of the falciform ligament matched the ones seen radiologically in segments IV and V of the liver. They were deroofed together with the others imaged on CT and confirmed using intraoperative ultrasonography. Improvement in imaging helps to accurately localise multiple and multiloculated liver abscesses. (d) Specimen photograph shows concomitant intra-abdominal pathology, such as a ruptured spleen, which was also dealt with at surgery. The bisected spleen revealed copious amount of pus. He recovered and went home two weeks after surgery.

outcome with PCD.[5] A subsequent randomised trial by Yu et al, with unlimited aspiration showed comparable results with equal failure rate of 3%.[6] The overall mortality of 7.8% reported in the study was due to uncontrolled sepsis in patients with concomitant malignancies. In these patients, surgery upfront is hazardous and thus percutaneous drainage is also ideal to stabilise their condition for subsequent complementary intervention (Fig. 2). PCD allows controlled drainage of large abscesses over a period of time with minimal haemodynamic and physiological stress to the patient. It is also the only definitive treatment for those with no other surgical pathology (Figs. 3 & 4).

Surgical drainage

There has been much debate over the merits of percutaneous vs. surgical drainage as the clinical intervention of choice. Percutaneous drainage has been touted to be as safe as, and more tolerable than, surgery in selected series. In most retrospective studies comparing the two methods, PCD seems to have comparable results (mortality rate), hence its status as the first-line drainage modality[7-11] (Table I). It also has lower morbidity and is definitely more acceptable to patients compared to surgery. However, there must be caution in interpreting these data. Poor prognostic factors for mortality are related to systemic effects of sepsis, advanced age and comorbidities.[4,7-10] As such, surgery may be prudent as the initial urgent treatment in patients with ruptured abscesses (Fig. 5), or complicated concomitant biliary disease, or intraabdominal disease (Fig. 6). The failure of percutaneous drainage can lead to uncontrolled sepsis, culminating in death in most series, but there are often inappropriately reported as surgical mortality when salvage surgical drainage was undertaken. While percutaneous catheter drainage may be the initial line of drainage to stabilise these conditions in high risk patients, definitive surgery may still be necessary.

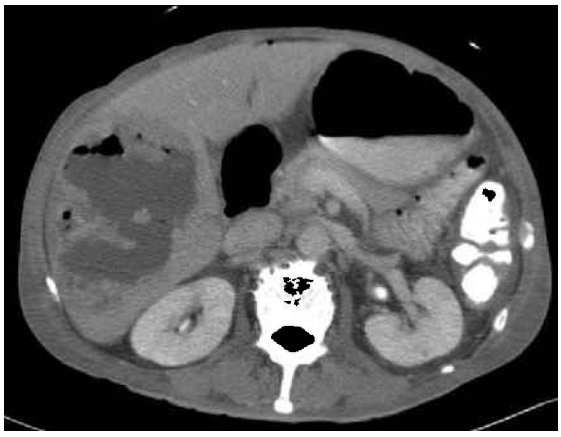


Fig. 7 Axial CT image of a 68-year-old man with diabetes mellitus who had worsening upper abdominal pain over two weeks. There was free gas in both the falciform ligament area and perihepatic fluid surrounding the abscess in segment VI, suggestive of rupture. He had peritonitis and required surgical drainage.

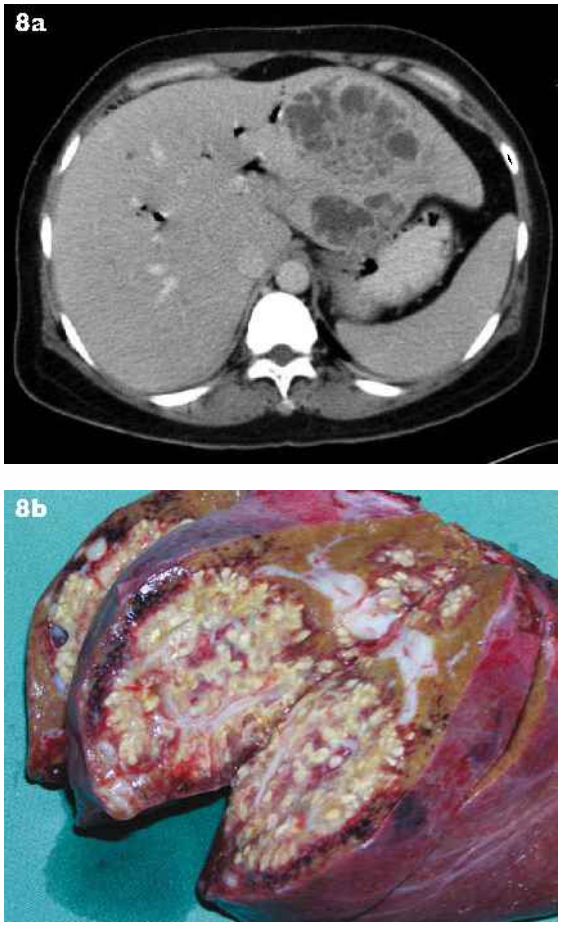


Fig. 8 A 48-year-old woman with previous cholecystectomy and endoscopical sphincterotomy presented with cholangitis. (a) Axial CT image shows an 8-cm multiloculated abscess in the left lateral segment of the liver. Resection was undertaken after a short period of intravenous antibiotics. (b) Photograph of the cut specimen shows multiple small abscesses and dilated ducts which otherwise would not be drainable percutaneously or surgically.

OD using the most basic tool, the human fingers, allows locules of the abscess to be broken down effectively, and subsequent large bore drains to be placed into the cavity (Fig. 7). Concomitant biliary pathology can also be dealt with using this method. Perhaps, this is why the recent comparative study by Tan et al showed that OD may be the better modality compared to percutaneous drainage.[3] In a series with 80% multiloculated abscesses ≥ 5cm and 24% biliary aetiology, OD had less treatment failures, less requirement for secondary procedures and shorter hospital stay. Size and multiloculation seems to be predictors for failure of percutaneous drainage in this series. Data from another local institution by Liew et al also found multiloculation to be a statistically-significant prognostic factor for morbidity.[2] Hence, the question of whether all large, multiloculated abscesses should be surgically drained merits a randomised controlled trial. In general, OD also has better access to difficult sites, such as the dome, and allows better haemostasis in patients with severe coagulopathy.

In the global modernisation of the healthcare system, the type of treatment offered impacts greatly on the cost and quality of life of the patients with liver abscesses. These should be included as study end points in any trial design. While there is an impetus to conduct evidence-based treatment through prospective clinical trials, there must be a concerted effort to improve the standard of treatment modality. The success of drainage technique rests heavily on the skills and experience of the interventional physicians or the subspecialist surgeons. Minimal access surgery is revolutionising treatment of surgical disease in all areas. LD offers all the advantages of OD with minimal stress and invasion to the human body. A recent comparative review by Wang et al showed shorter surgery time, less blood loss, faster recovery and shorter hospital stays in the LD group compared with those who had undergone OD.[12] Improvements in laparoscopic techniques, instruments and imaging will make LD a worthy competitor to percutaneous modality. There is a role for surgery for large and complicated liver abscesses. Percutaneous approach is still favoured as the initial modality of drainage, but patients need to be carefully selected and closely monitored. These modalities are in fact complementary in the management of liver abscess.

RESECTION

Liver resection is part of the surgical armamentaria in the treatment of liver abscesses. Specific indications include liver carbuncle and associated hepatolithiasis, especially in the left lobe, commonly found in recurrent pyogenic cholangitis[8] (Fig. 8). Suspicious

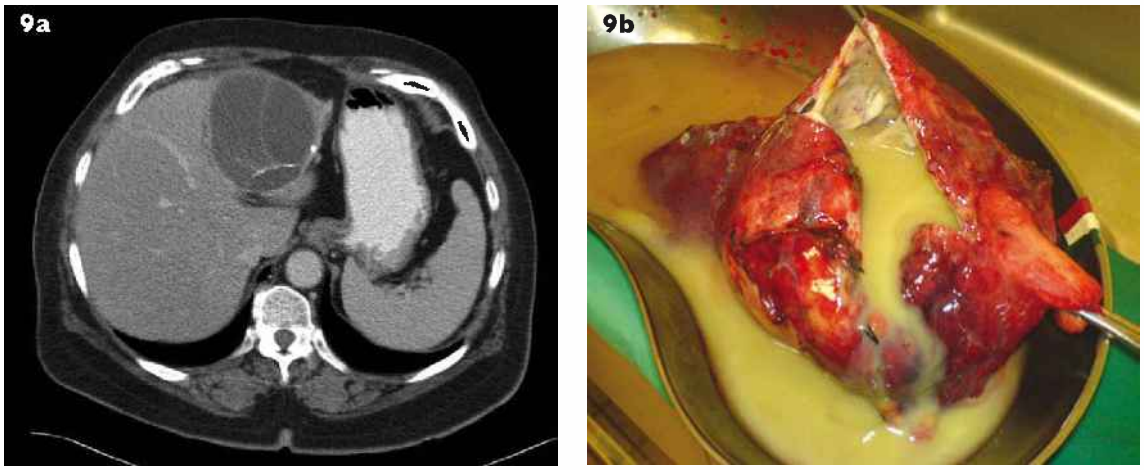


Fig. 9 A 59-year-old woman with diabetes mellitus presented with fever and upper abdominal pain. (a) Axial CT image shows a solitary septated, calcified cystic lesion in the left lobe of the liver. The appearance was suggestive of an infected biliary cystadenoma. After a short course of antibiotics and stabilisation of her diabetes, a left hemihepatectomy was performed. (b) Operative photograph shows frank pus on bisecting the specimen and microscopy confirmed initial suspicion of biliary cystadenoma, a tumour with malignant potential. Tumour mimicry of liver abscess requires a high index of suspicion to enable the appropriate modality of treatment to be used.

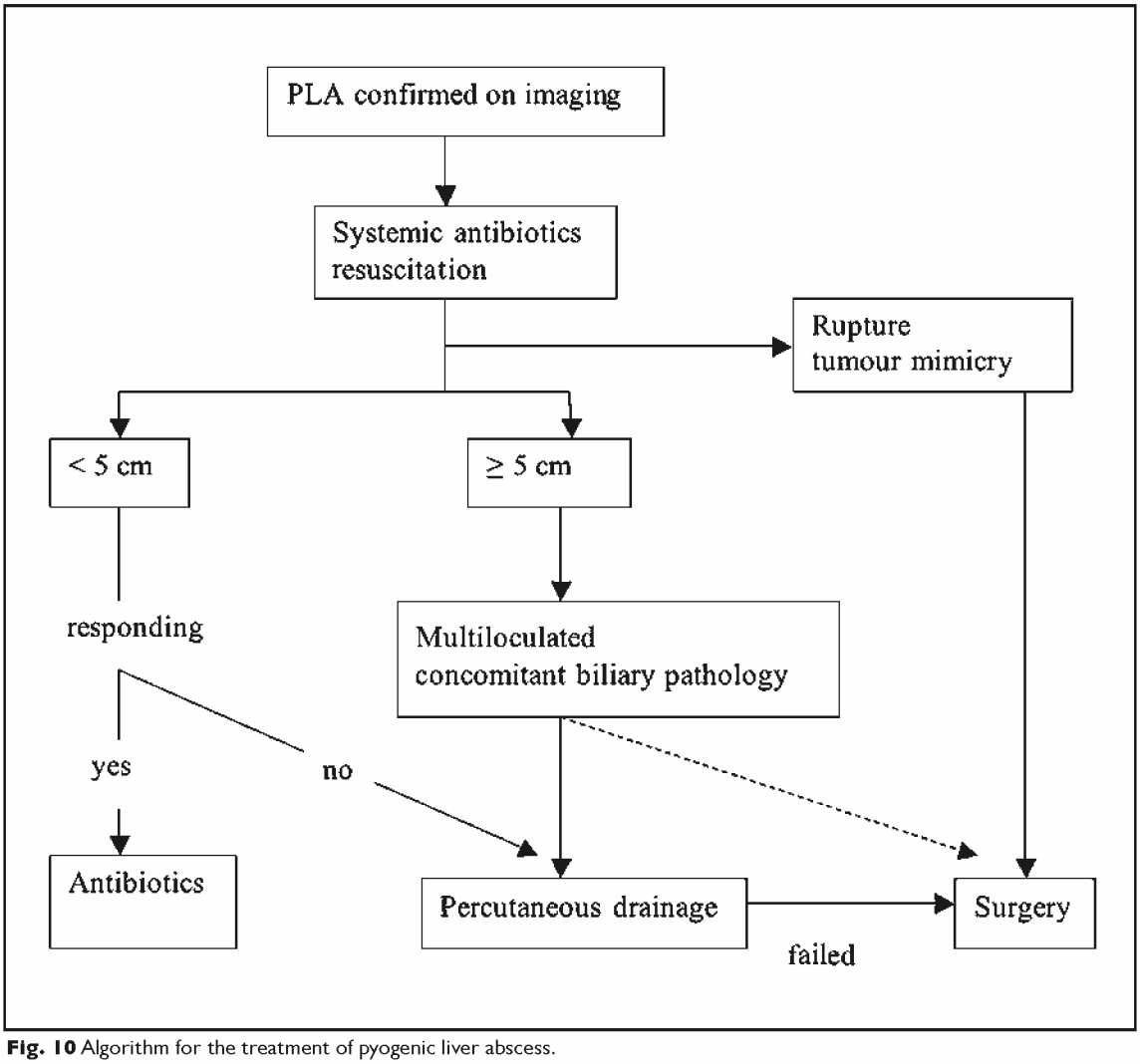


Fig. 10 Algorithm for the treatment of pyogenic liver abscess.

liver lesion with concomitant infection requires treatment of the sepsis before surgery is undertaken (Fig. 9).

CONCLUSION

This review underlines the importance of drainage in reducing the time for resolution of sepsis and prevention of mortality. Therapy needs to be individualised according to patient's clinical status and abscess factors (Fig. 10). Percutaneous image-guided drainage is appropriate as first-line treatment when there are no urgent surgical indications for peritonitis. Surgical drainage may be considered in large, multiloculated abscesses and those associated with concomitant biliary pathology. Future improvement in laparoscopic techniques and equipments will enhance its surgical role in the treatment of liver abscesses. Resection is indicated in abscesses associated with intrahepatic calculi and suspected tumour.

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SINGAPORE MEDICAL COUNCIL CATEGORY 3B CME PROGRAMME
Multiple Choice Questions (Code SMJ 200712B)

	True	False
Question 1. Regarding pyogenic liver abscesses:		
(a) A surgical consultation is necessary for patients with peritonitis and in septic shock.	☐	☐
(b) There is considerable improvement in outcome due to the advent of antibiotics, imaging and critical care.	☐	☐
(c) Poor prognostic indicators are systemic effects of sepsis, advanced age and comorbidities.	☐	☐
(d) The commonly-isolated bacteria locally is *Klebsiella pneumoniae*.	☐	☐
Question 2. Regarding systemic antibiotics:		
(a) They are the first-line and mainstay of treatment in pyogenic liver abscesses.	☐	☐
(b) They must be broad-spectrum and appropriate to the locally prevalent organism.	☐	☐
(c) When used alone, the duration of therapy of two weeks is sufficient.	☐	☐
(d) They are ideally used alone in large liver abscesses ≥ 5 cm in size.	☐	☐
Question 3. Regarding drainage:		
(a) It is usually needed for large abscesses ≥ 5 cm to facilitate resolution of sepsis.	☐	☐
(b) Percutaneous drainage is less tolerable than surgery and is used as the last resort.	☐	☐
(c) It can be done percutaneously using aspiration needle or catheter placement.	☐	☐
(d) Surgery has less treatment failures in large and multiloculated abscesses compared to percutaneous drainage.	☐	☐
Question 4. Percutaneous drainage:		
(a) Can be done under local anaesthesia and is minimally invasive.	☐	☐
(b) Does not need any imaging to aid in localising the abscess.	☐	☐
(c) Is the definitive therapy for patients with concomitant biliary disease.	☐	☐
(d) Can be used to stabilise high-risk patients before definitive intervention.	☐	☐
Question 5. Regarding surgical drainage:		
(a) It is urgently needed for patients with perforated abscesses and peritonitis.	☐	☐
(b) It does not allow concomitant biliary pathology such as gallstones or common bile duct stones to be treated at the same time.	☐	☐
(c) It allows locules of the abscess to be broken and placement of large bore drains compared to percutaneous drainage.	☐	☐
(d) Resection is necessary for liver carbuncle or localised intrahepatic disease associated with recurrent pyogenic cholangitis.	☐	☐

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