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## Laparoscopic approach for pancreato-splenic abscess from disseminated melioidosis: Surgical outcome and review of literature

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### ABSTRACT

Melioidosis is a severe systemic infection caused by *Burkholderia pseudomallei*. It commonly affects the lungs, liver and kidneys. Pancreatic and splenic abscess from melioidosis is rare, with few reports in the literature. We present a series of 4 patients with disseminated melioidosis of pancreas and spleen who required surgical intervention. A MEDLINE database review was conducted. Relevant publications were evaluated and demographic data, clinical, radiological findings as well as management options were collected. We found 10 case reports describing this clinical condition. In our series, median age was 57. Median operative time 260 minutes. All four patients failed trial of antibiotic therapy and required surgery. Three underwent distal pancreatectomy and one underwent splenectomy alone. Laparoscopic distal pancreatectomy was successful in two patients. Median length of stay 11.5 days. No post-operative complications and mortality reported. Surgery is indicated in failed medical therapy and laparoscopic approach is safe and feasible.

**Keywords:** laparoscopic surgery, melioidosis, spleen, pancreas

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## INTRODUCTION

Melioidosis is a severe systemic infectious disease caused by *Burkholderia pseudomallei*, a Gram-negative bacillus with bipolar staining. Melioidosis is commonly found in soil, groundwater, ponds and rice paddies throughout endemic regions, which are Southeast Asia and Northern Australia. [1] The disease is transmitted through contact with contaminated soil or water by percutaneous inoculation, aerosol inhalation or ingestion of contaminated food or water. With a fatality rate of 19-36% in endemic areas, this disease should not be taken lightly and appropriate treatment should be instituted early. [2, 3] Melioidosis is well reported for its propensity to cause abscesses, with liver and splenic abscess being the more common form. [4] However, there is only a sparsity of case reports in the literature. We present a case series of pancreato-splenic abscess from melioidosis requiring surgical intervention and a review of its literature.

## Methods

All the cases that were admitted to our institution requiring surgical intervention for pancreato-splenic melioidosis from January 2016 to December 2019 were reviewed. We also conducted a MEDLINE database review of the relevant medical literature published in English from year 1980 to 2021 and identified all reported cases of pancreatic/ splenic abscesses caused by melioidosis that required surgical intervention using the following keywords: melioidosis, pancreas, spleen, and abscess. Relevant publications were evaluated and demographic data as well as findings and clinical outcomes were collected.

## Results

A total of 10 articles were found describing this clinical condition. All patients failed conservative management and required surgical interventions. In this series, we present 4 cases of pancreato-splenic abscesses from melioidosis requiring surgery. The patients' characteristic and clinical information as well as

outcome are summarized in Table 1. Median age of patients in our series was 57, with all patients being male. Three patients had predisposing medical condition of diabetes mellitus. All patients failed initial conservative treatment with antibiotics and underwent distal pancreatectomy and splenectomy. No post-operative complications and mortality was reported. Follow up scans revealed resolution of intra-abdominal abscesses.

## CASE SERIES

### Case 1

Case 1 was a 58-year-old man with no past medical history, admitted to us for fever with chills and rigors for 1-week duration. On admission, he was lucid with normal clinical examinations of heart, lungs and abdomen. However, he developed type 1 respiratory failure secondary to acute pulmonary oedema shortly after admission. He was intubated and transferred to intensive care unit [ICU] for inotropic support. Blood investigations revealed haemoglobin levels of 13.0 g/dl, white cell count of  $22.6 \times 10^3/\mu\text{L}$ , platelet levels of  $218 \times 10^3/\mu\text{L}$ . His inflammatory markers were raised with C reactive protein [CRP] levels of 250.8 mg/L and procalcitonin levels of 10 ug/L.

Liver function test performed revealed bilirubin of 30.5  $\mu\text{mol/L}$ , alkaline phosphatase [ALP] of 261 U/L, alkaline transaminase [ALT] of 56 U/L and aspartate transaminase [AST] of 50 U/L. His renal function was deranged with sodium levels of 121 mmol/L, potassium of 4.3 mmol/L, creatinine of 90  $\mu\text{mol/L}$  and urea of 5.3 mmol/L. Blood cultures grew *Burkholderia pseudomallei*, and candida.

Computed tomography [CT] scan of the abdomen and pelvis was performed to identify source of infection. It revealed multiple irregular hypodense areas within the spleen, subcapsular abscess at inferior pole of the spleen and an abscess locule abutting the pancreatic tail. [Figure 1a] He was started on intravenous [IV] meropenem and anidulafungin. Splenectomy was offered to the patient but he was not keen to

undergo the surgery. A repeat ultrasound of the abdomen was performed 4 days later, which revealed worsening of the splenic abscesses. Although his respiratory requirements improved and he was extubated on day 4 of ICU admission, he was initiated on renal replacement therapy [CRRT] for acute kidney injury.

Table 1: Demographics and management of pancreato-splenic abscess from melioidosis.M: male, F: female, DM: diabetes mellitus, CT: computed tomography, Lap: laparoscopic, OSA: obstructive sleep apnoea, CKD: chronic kidney disease

No .	Author/Year/Reference	Gender	Age	Symptoms	Comorbidities	White cell counts [ $\times 10^3$ cells/uL]	CRP [mg/dL]	Radiological features	Treatment
1.	Hai Chen <i>et al.</i> , 2018 <sup>[16]</sup>	M	55	Abdominal pain, fever, loss of weight	Nil	17	56.6	Hepatic disease, spleen abscess and calcification	Splenectomy
2.	Deng-Wei Chou <i>et al.</i> , 2016 <sup>[17]</sup>	F	50	Abdominal pain, fever	DM	10.5	31.6	Splenomegaly and multifocal splenic infarctions	Splenectomy
3.	Fibi Ninan <i>et al.</i> , 2018 <sup>[18]</sup>	M	53	Fever, left upper abdominal pain	DM	nil	9.8 mg/L	Splenic lesions with peripheral calcifications	Splenectomy
4.	Liv Hesstvedt <i>et al.</i> , 2011 <sup>[19]</sup>	M	38	Fever, abdominal pain	DM	10.7	100 mg/dl	Splenic abscess	Splenectomy
5.	Miraclin AT <i>et al.</i> , 2017 <sup>[20]</sup>	F	Young	Left sided abdominal pain, fever	Thalassemia intermedia	Nil	Nil	Splenic abscess with perisplenic collection.	Splenectomy
6.	Ashish Jitendranath <i>et al.</i> , 2016 <sup>[21]</sup>	M	41	Fever, left upper abdominal pain	DM	29.5	Nil	Multiple well defined splenic abscess	Splenectomy
7.	Tak Kuan Chow <i>et al.</i> , 2016 <sup>[22]</sup>	M	54	Asymptomatic - Incidental findings from histology following splenectomy for road traffic accident	Nil	Nil	Nil	US: free fluid in left splenorenal recess	Splenectomy
8.	Seymour Levine <i>et al.</i> , 1968 <sup>[23]</sup>	M	26	Fever, loss of weight	DM	8.2	Nil	Fluoroscopy: splenomegaly	Splenectomy
9.	J Maytapa <i>et al.</i> , 2018 <sup>[24]</sup>	M	52	Fever, abdominal pain	DM	12	Nil	CT: Multiple rim-enhancing hypodense lesions in the spleen with eroding to gastric fundus	Splenectomy and repair of gastrosplenic fistula
10.	Wu YC <i>et al.</i> , 2010 <sup>[25]</sup>	M	54	Fever, abdominal pain, loss of appetite	DM	8.2	Nil	CT: Splenic abscess	Splenectomy
11.	Case 1	M	58	Fever	Nil	22.6	250.8	CT: multiple irregular hypodense areas within the spleen	Lap distal pancreatectomy and splenectomy
12.	Case 2	M	75	Fever and URTI	DM,CKD	9.9	97.6	CT: multiple splenic abscesses with capsular breach at the inferior aspect and subcapsular collections	lap distal pancreatectomy and splenectomy
13.	Case 3	M	57	Prolonged fever	DM,OSA	12.8	85.1	CT: splenomegaly with multiple abscesses	Lap converted to open distal pancreatectomy with splenectomy
14.	Case 4	M	57	Fever and abdominal pain	DM	10.8	239	CT: large splenic abscess as well as liver abscess	Lap converted to open splenectomy

After 14 days of IV antibiotics, a repeat CT scan of the abdomen and pelvis revealed progression of the abscess in both the spleen and tail of the pancreas. [Figure 1b]. Patient finally consented for surgery. He underwent laparoscopic distal pancreatectomy and splenectomy. Intra-operatively there were multiple pus loculations at the pancreatic tail and the spleen. Post-operatively, he recovered well and completed 6 weeks of antibiotics. Post splenectomy vaccinations were also administered. His

hospital stay was prolonged in view of his initial stormy presentation as well as physical deconditioning requiring inpatient rehabilitation post-operatively. He was discharged well on post-operative day [POD] 42. He was finally discharged well and stable on post-operative day [POD] 42. A repeat CT scan of the abdomen and pelvis 7 months later showed resolution of the abscesses with the residual pancreas appeared unremarkable.

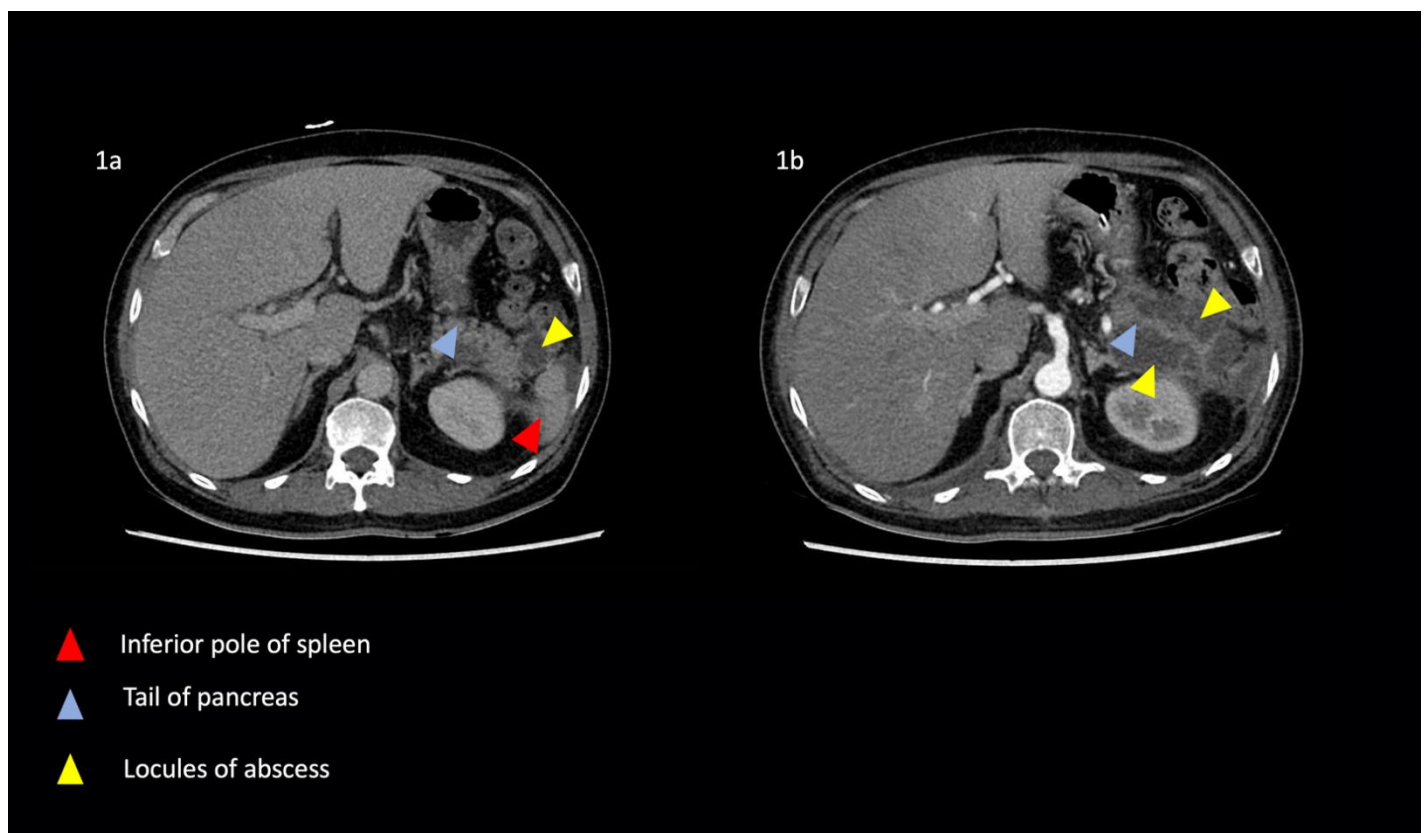


Figure 1a: CT abdomen pelvis revealed subcapsular inferior pole splenic abscess with another locule of abscess abutting the tail of the pancreas at the initial presentation to the hospital.

Figure 1b: A repeat CT after 14 days of antibiotics showed progression of infection with more coalescing abscesses in the pancreatic tail and spleen.

## Case 2

Case 2 is 75-year-old man with diabetes mellitus, hypertension, hyperlipidaemia and chronic kidney disease. He was admitted to our institution for fever of 3 days' duration which was associated with symptoms of upper respiratory tract infection. Physical examination was unremarkable. Blood investigations revealed

haemoglobin levels of 9.7 g/dl, white cell count of  $9.9 \times 10^3/\mu\text{L}$  and platelet of  $218 \times 10^3/\mu\text{L}$ . His CRP was raised at 97.6 mg/L but procalcitonin was normal at 0.37ug/L. Liver function test and renal panel were unremarkable. Blood culture grew *Burkholderia pseudomallei*.

CT scan of the chest, abdomen and pelvis revealed left lung upper lobe cavitation and

multiple splenic abscesses with capsular breach at the inferior aspect and subcapsular collections. [Figure 2a] Bronchoscopy was performed in view of CT scan findings of the left lung upper lobe cavitation and melioidosis PCR was positive from bronchoscopy lavage. He was treated conservatively with intravenous antibiotics for 6 weeks and discharged with an outpatient antibiotic therapy regime. His follow up CT scan after 1 month showed reduction of left lung upper lobe cavitation but increase in size of the splenic abscesses as well as the perisplenic collection involving the tail of pancreas.

[Figure 2b] In view of the scan findings, he was offered laparoscopic distal pancreatectomy and splenectomy. Intra-operatively, there were multi-loculated large splenic abscess involving also the splenic flexure splenic hilum and tail of pancreas. Post-operatively he recovered well and discharged on POD 7 with 6 weeks of PO antibiotics. The follow up CT scan showed resolution of the abdominal abscess. He had completed 3 months of oral antibiotics for lung abscess and he is currently still on oral augmentin for chronic suppression of lung abscess.

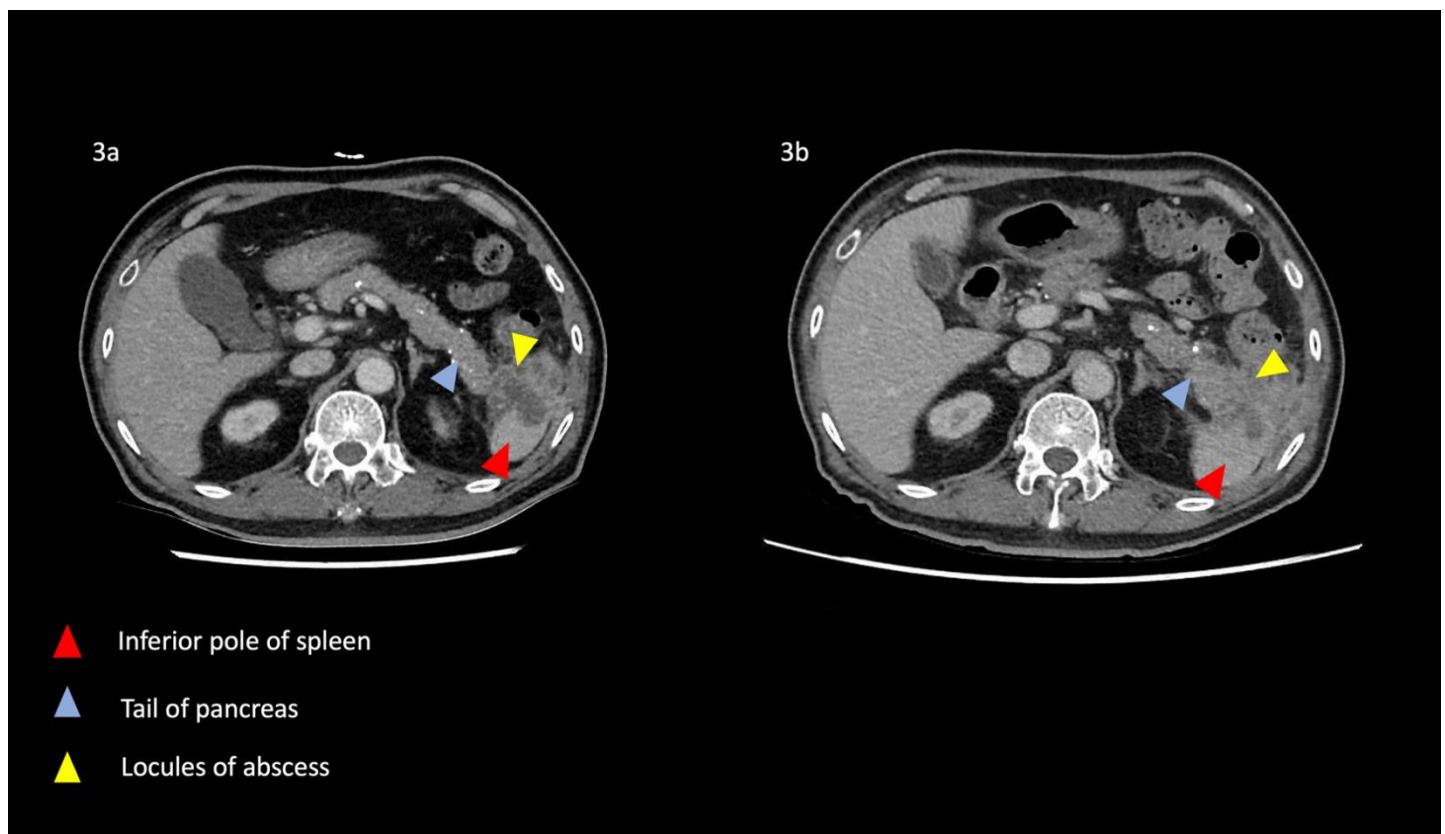


Figure 2a: Multiple locules of splenic abscess with capsular breach at the inferior aspect and subcapsular collections; there was no involvement of the pancreatic tail.

Figure 2b: Increase in size of multiple splenic abscesses with abscess and progression to involve tail of pancreas.

### Case 3

Case 3 was a morbidly obese 57-year-old male with diabetes mellitus, obstructive sleep apnoea and pulmonary melioidosis that was treated with 6 weeks of antibiotics 2 years ago. He was admitted to our institution after he had

persistent fever for 2 weeks. On examination, there was no abdominal sign on admission.

His haemoglobin level was 15.1 g/dL, white cell count was raised at  $12.8 \times 10^3/\mu\text{L}$  and platelets level was  $412 \times 10^3/\mu\text{L}$ . Renal panel and liver function test were unremarkable. His CRP level



was raised at 85.1 mg/L and procalcitonin was 0.29 ug/L. Blood culture grew *Burkholderia pseudomallei*.

CT scan of the abdomen and pelvis revealed an enlarged spleen with multiple abscesses in the spleen with one locule of abscess abutting the tail of pancreas. [Figure 3a] Melioidosis serology was positive. He was started on IV Ceftazidime for 6 weeks' duration and discharged well and stable. However, during his follow up at 3 months, he was noted to have a right neck lump and was admitted for further work up. CT neck revealed a 3.9cm multi-septated, rim enhancing hypodense abscess collection in the right upper neck with another smaller 1.2cm abscess right level II cervical lymph node. Needle aspiration of

the abscess yielded frank pus and melioidosis PCR was positive too.

A repeated CT thorax, abdomen and pelvis were then performed in view of the recurrent disseminated melioidosis. It showed interval increase in splenic abscess and a new abscess in the pancreatic tail. [Figure 3b] He was counselled for splenectomy in view of failed conservative management with IV antibiotics. He underwent laparoscopic distal pancreatectomy with splenectomy. However, it was converted to open in view of bulky and swollen spleen from the abscess and scarring of the splenic hilum from medial spreading of the splenic abscess that prevented safe dissection.

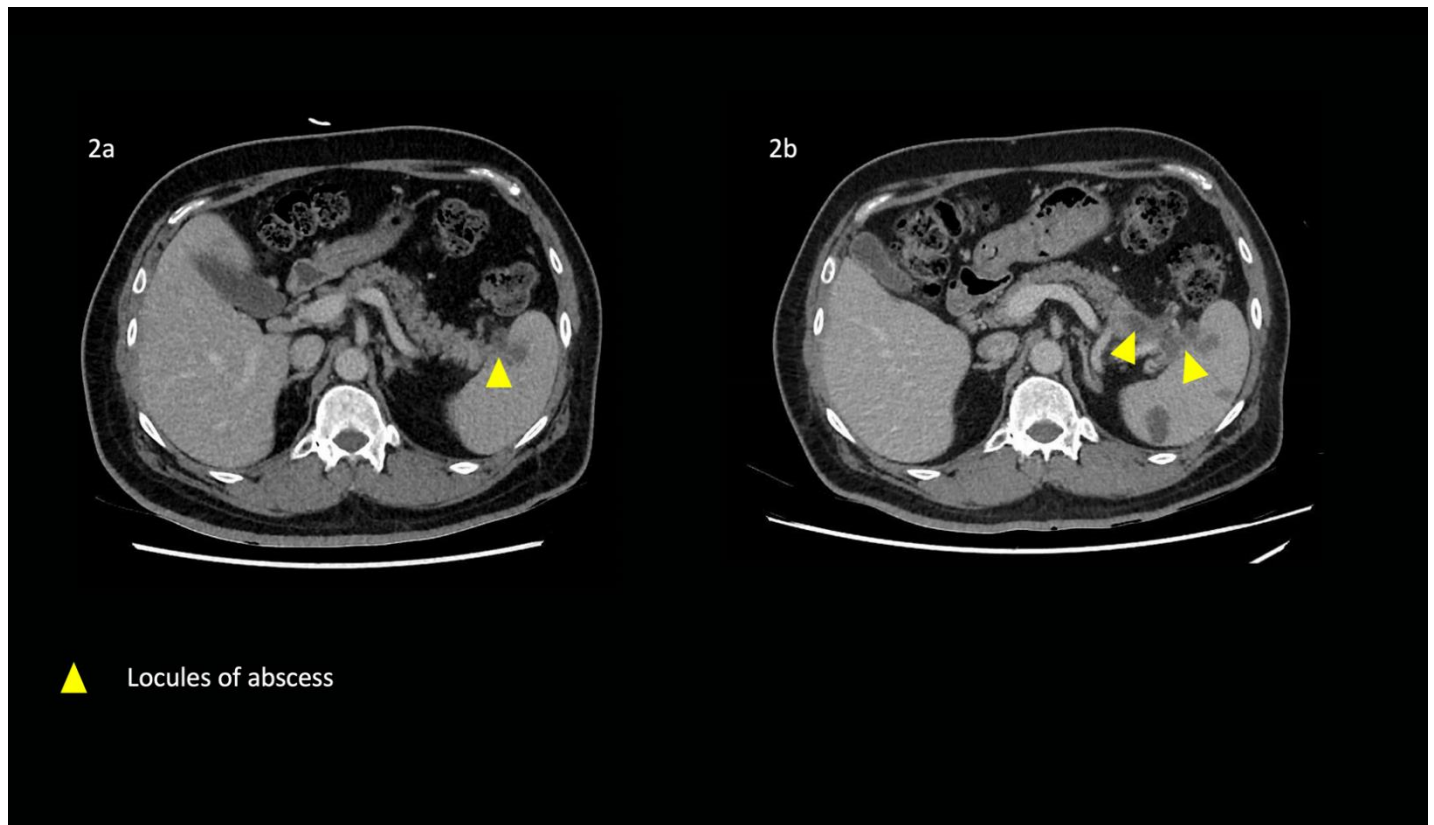


Figure 3a: Splenic abscess abutting the tail of pancreas at initial presentation to hospital.

Figure 3b: interval increase in splenic abscess and new abscess in the pancreatic tail.

Post operatively, he recovered well and completed 6 weeks of IV antibiotics via outpatient antibiotic therapy. He was discharged well and stable on POD 14. He was seen at outpatient clinic 1-month post discharge where he was well with no new symptoms. He

completed oral antibiotics and was discharged from our follow up.

#### Case 4

Case 4 was a 57-year-old male with diabetes mellitus who presented with one week of fever.

On physical examination, there was epigastric tenderness. His white cell count was mildly elevated at  $10.8 \times 10^3/\text{UI}$ . His haemoglobin and platelet counts were normal. Inflammatory markers of CRP and procalcitonin were raised at 239mg/L and 40.5ug/L respectively. His liver function test was also deranged with ALP of 245 U/L ALT 65 U/L and AST 72 U/L. Blood culture grew *Burkholderia pseudomallei*.

CT scan of the abdomen and pelvis revealed a large splenic abscess. [Figure 4a] He was initially treated conservatively with IV Ceftazidime. The interval CT abdomen pelvis

after 2 weeks of IV antibiotic treatment showed worsening of the splenic abscess. [Figure 4b] He was counselled and consented for laparoscopic splenectomy. The surgery was converted to open due to dense adhesion from the inflammatory tissue of the ruptured splenic abscess. There was no post-operative complication and he was discharged well and stable on POD 9. He was seen in our outpatient specialist clinic where he was well and asymptomatic. A repeat CT at 12 months showed resolution of the abscesses. He completed 6 weeks of IV ceftazidime and PO Bactrim for 6 months.

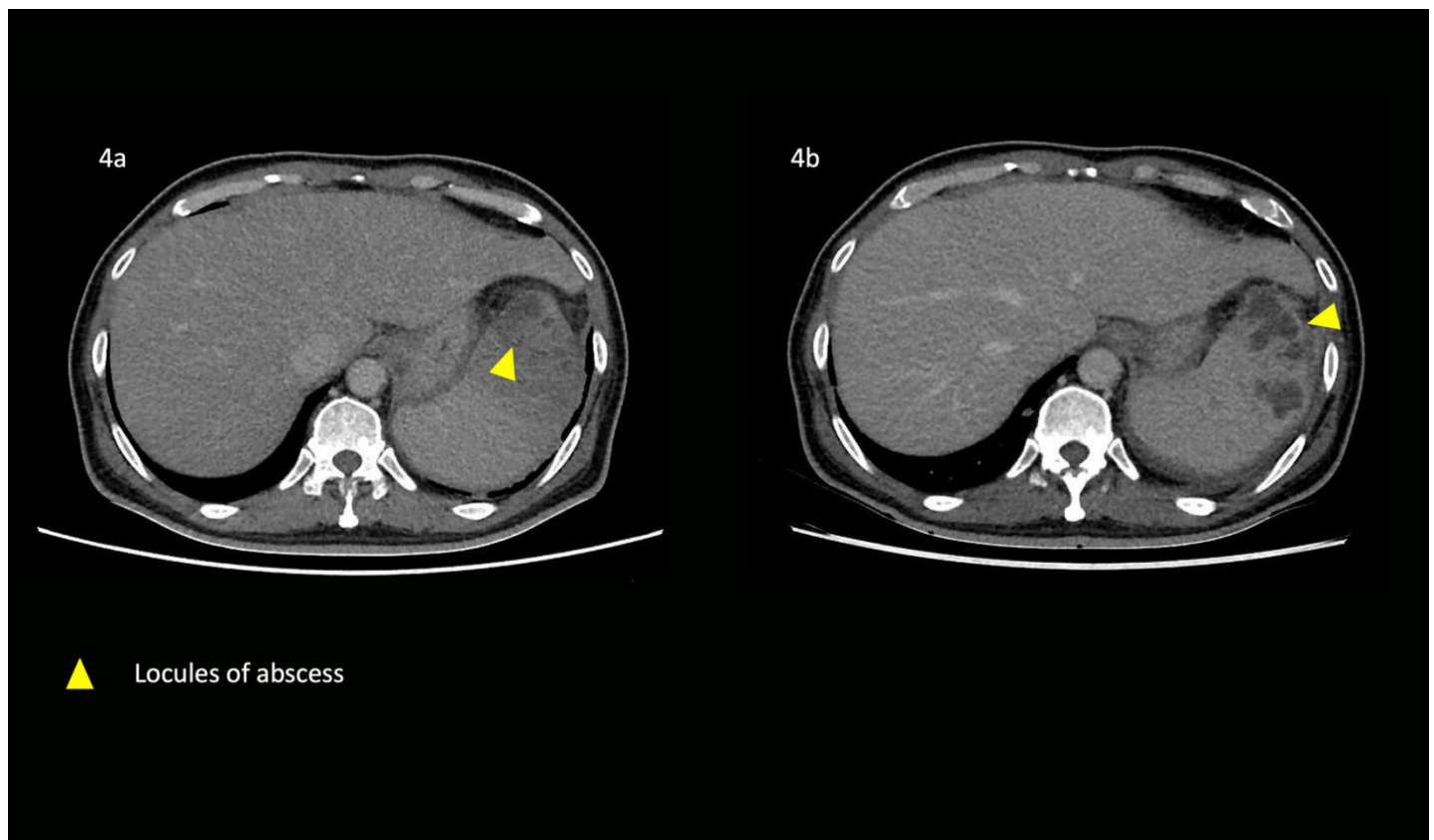


Figure 4a: Large multiloculated splenic abscess at initial presentation

Figure 4b: CT scan after 2 weeks of IV antibiotic therapy demonstrating progression of splenic abscess

### Surgical technique for laparoscopic distal pancreatectomy and splenectomy

The patient was positioned in a 15-degree reverse Trendelenburg with slight tilting up of the left side of the body. A 12 mm port for camera was inserted to supraumbilical area using open

cut-down technique. Further 12mm port and 2 other 5mm ports were inserted as indicated in Figure 5. The Lesser sac was entered by taking down the gastrocolic ligament, the splenic flexure was then mobilised. Combination of blunt dissection with laparoscopic sucker and

sharp dissection with Harmonic scalpel were applied. The splenic artery was dissected out from superior pancreas, it was then doubly ligated with Hem-o-lok [West Closure Systems, Research Triangle Park, NC] and transected. The lateral to medial approach was used by mobilising the spleen fully towards the tail of pancreas. The tail of pancreas was then transected together with the splenic vein with

powered Echelon flex 60mm blue reload. The pancreatic stump was then over-run with prolene 4/0 to ensure adequate hemostasis. Evicel Fibrin Sealant was applied to the pancreatic stump. Two surgical drains were placed to the left subphrenic space and to the pancreatic stump respectively. A small wound extension was performed at umbilical port site for specimen retrieval.

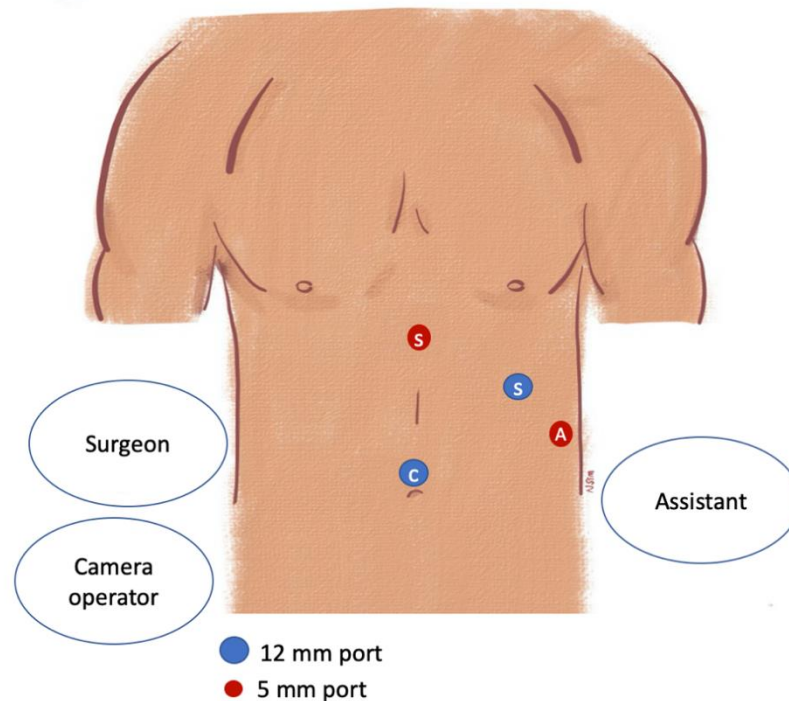


Figure 5: Port placements during laparoscopic distal pancreatectomy and splenectomy.  
S: surgeon, A: assistant, C: camera port

## DISCUSSION

Melioidosis is an emerging infectious disease caused by the non-spore forming, gram negative soil saprophytic bacillus *Burkholderia pseudomallei*. It mainly occurs in pandemic areas such as Southeast Asia and northern Australia region. [5] The disease is acquired from contact with contaminated soil or water through abrasions and minor cuts, as well as by the inhalation of aerosols and ingestion.

Clinical manifestation in human can be in various forms, from acute fulminant septicaemia to localized soft tissue lesions, visceral abscesses [more commonly in the spleen, liver

and lung], chronic melioidosis and latent melioidosis. Latent melioidosis is defined as an asymptomatic infection, which can later develop into active disease at an indeterminate time after the initial infection. [6] The incidence of septic shock occurred in 40% of cases and the mortality rate ranging from 26% to 80%. [7] In our series, case 1 developed acute fulminant septicaemia with respiratory failure requiring ventilator support while the rest of the cases developed localized abscesses as well as chronic melioidosis. Most patients who contracted the disease have well-known predisposing factors, such as diabetes mellitus,



chronic kidney disease, chronic lung disease or immunocompromised. [8]

In our review, majority patients are male, 12[85.7%]. Median age was 57, ranging from 38 to 74 years old. Most common risk factor is diabetes mellitus, with 10 patients predisposed to it [71.4%]. All patient failed conservative treatment with antibiotics and required surgical intervention. All the patients who underwent distal pancreatectomy and splenectomy did not have grade B/C pancreatic leak. None of our patients who underwent surgery had Clavien Dindo 3 and above complications.

The most common involved sites of melioidosis are lung, blood stream, liver and spleen. [9] Clinical presentations are based on the site infected, with fever always being the predominant symptom. In our series, all 4 patients developed fever prior to admission.

Common sonographic findings of visceral melioidosis consist of small [less than 2cm], discrete, multi-loculated lesions with a target-like appearance due to early central necrosis of the affected tissue and prominent fibrin content. CT is the most accurate modality with the hallmark being a low attenuation area with enhancing rim. [10] In our series. CT scan of the abdomen and pelvis revealed multiple abscesses in the spleen and the pancreas. Similar to the all the other cases in the literature review which required CT scan for diagnosis of the splenic abscesses.

Culture and isolation of *B. pseudomallei* from clinical samples are crucial tests for diagnosis. Abscesses in abdominal organs are well reported, especially in kidney, spleen and prostate. A study from Singapore reported that *Burkholderia pseudomallei* is the most common etiological agent for splenic abscesses. [11] Prolonged antibiotic therapy is required for treatment of visceral melioidosis. Typically, it is susceptible to ampicillin/sulbactam, chloramphenicol, tetracycline, Bactrim [sulphamethoxazole- trimethoprim], third- generation cephalosporins and carbapenem.[12] Therapies generally suggested

for 10-14 days followed by oral antibiotics for a minimum of 3 months. In cases of treatment failure or worsening abscesses despite antibiotics, surgery is indicated.

Splenectomy has long been considered the standard treatment of splenic abscess. It can be done via open or laparoscopic method. In patients without prior abdominal surgery, stable hemodynamics status and in institution where surgical expertise is available, laparoscopic approach should be attempted. Hakan et al reported that laparoscopic splenectomy is superior with regards to hospital stay, start time to diet, wound infection and cosmesis. [13] Laparoscopic approach is superior as patients will have smaller scar, shorter recovery time and length of stay. In our region, 112 robotic hepatopancreato-biliary cases were performed over a 5-year period. [14] The high number of caseload demonstrated that our institution is capable of performing laparoscopic splenectomy. The analysis: of comparative trials of laparoscopic versus open splenectomy are also in favour of laparoscopic splenectomy. [15]

In our report, 2 patients underwent laparoscopic distal pancreatectomy and splenectomy while the other 2 had open conversion due to dense adhesions. All patients recovered well from the operation with no post-operative complications. Patients who underwent surgery benefited from shorter duration of antibiotics [6 weeks instead of 3 months] except in cases with synchronous infection. We had demonstrated that laparoscopic splenectomy with/ without distal pancreatectomy is a safe and effective method in treating pancreato-splenic abscess from melioidosis who failed the conservative management.

## Conclusion

In conclusion, splenic and pancreatic melioidosis who failed medical treatment with antibiotics should be considered for surgery. Laparoscopic approach, while technically difficult, can be successful in selected patients in experienced hands.

## DECLARATIONS

### Conflicts of interest

All authors declared that there are no conflicts of interest.

### Authors' contributions

Made substantial contributions to conception and design of the study and performed data analysis and interpretation: HJ Tan, LS Lee, AKH Chiow, N Thiruchelvam, SS Tan

Performed data acquisition, as well as provided administrative, technical, and material support: HJ Tan, LS Lee

### Availability of data and materials

Not applicable

### Financial support and sponsorship

None.

### Consent for publication

Informed consent was obtained from participating individual included in the report.

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