Computed tomography of focal splenic lesions in patients presenting with fever

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ABSTRACT

Introduction: There is an awareness of the increased incidence of splenic abscess in Southeast Asia giving rise to unexplained fever. This study looks at the role of computed tomography (CT) in evaluating focal splenic lesions in patients presenting with fever.

Methods: 37 patients presenting with fever of unknown origin underwent CT and this study retrospectively analyses the findings in these patients. 13 patients also had associated abdominal pain. Patients with conditions at high risk for splenic infection include: diabetes mellitus in ten patients, leukaemia in seven patients, human immunodeficiency virus infection in five patients, intravenous drug abuse in six patients, and steroid therapy in two patients. No risk factors could be identified in seven patients.

Results: Splenic abscess was diagnosed in 28 patients. A range of infecting organisms was isolated but the most frequent were *Staphylococcus aureus* (eight), tuberculosis (four), Streptococcus (four), fungal (four) and melioidosis (four). No infecting organism could be identified in ten cases though in patients with leukaemia with multiple low attenuation areas, the cause was presumed to be fungal. Six patients were diagnosed to have splenic infarcts though differentiation from splenic abscess could be difficult; these patients were treated for an abscess and all had endocarditis. Three patients were subsequently diagnosed with lymphoma. Percutaneous abscess drainage was performed in five patients and splenectomy was carried out in six patients.

Conclusion: CT proved to be very useful as it not only revealed the size and extent of any splenic abnormality but it assisted with guidance for percutaneous drainage, determined the site for biopsy, and provided follow-up after treatment.

Keywords: computed tomography, pyrexia of unknown origin, spleen, splenic abscess, splenic infarct

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INTRODUCTION

In patients presenting with fever of undetermined cause, particularly if abdominal pain is present as well, splenic abscess is the important consideration, although infarction can have a similar appearance. Many patients have an underlying condition which gives a clue to the splenic pathology. Splenic abscess is not a common condition but in Southeast Asia, melioidosis must be considered as a causative organism. Splenic infarction is associated with endocarditis and differentiation from an abscess can be difficult. Computed tomography (CT) is the preferred modality employed to image the spleen, as not only does CT reveal the presence of a splenic abnormality but it gives an indication of its nature, the site for possible biopsy or drainage and follow-up after treatment.

METHODS

This is a retrospective study performed over a two-year period from 2001-2003. 37 patients with unexplained fever, who were under the care of an infective disease physician, were found to have a splenic abnormality on CT. The CT scans were performed on a General Electric LiteSpeed scanner (General Electric, Milwaukee, WI, USA) following intravenous injection of 100ml Iopromide 300 mg I/ml at 2ml/sec using a pump injector.

The clinical presentation, presence of underlying disease, blood examination, microbiological culture from blood, or splenic aspiration together with the clinical outcome, were analysed to arrive at a diagnosis of splenic abnormality. Biopsy or aspiration of the spleen or splenectomy with histological examination and culture for micro-

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Table I. Risk factors for splenic abscess or infarction.

Disease	Number of patients
Diabetes mellitus	10
Leukaemia	7
Intravenous drug abuse (endocarditis)	6
Endocarditis	4
HIV	4
Steroid therapy	2
Myelofibrosis	1
Thalassaemia	1
No risk factors	4

NB: one patient had diabetes and thalassaemia; one patient diabetes and endocarditis.

Table II. Microbiological examination results.

Organism	Number of patients
Staphylococcus aureus	8
Tuberculosis	4
Melioidosis	4
Streptococcus	4
Fungal	4
Salmonella	2
Klebsiella	2
Enterobacter	1
Atypical tuberculosis	1
No organism isolated (presumed fungal 3)	10

NB: three patients had both *Staphylococcus aureus* and Streptococcus; one patient had Klebsiella and fungal infection.

Table III. Management of patients.

Treatment	Number of patients
Percutaneous drainage	5
Splenectomy (2 following percutaneous drainage)	6
Antibiotics	21

NB: Of the patients treated with antibiotics alone, all survived except one patient with endocarditis.

Table IV. List of final diagnosis.

Diagnosis	Number of patients
Splenic abscess	28
Splenic infarct	6
Lymphoma	3

organisms were performed in 14 patients, including three patients who were subsequently diagnosed with lymphoma. One patient had a biopsy of neck nodes and a further patient had a bone biopsy and the splenic abnormality was considered to be an abscess due to the same organism. Nine patients had no splenic intervention but had positive blood cultures and two patients had positive sputum cultures. In ten patients, the diagnosis of the splenic abnormality was made clinically.

RESULTS

Patients and presentation. There were 37 patients with a splenic abnormality, of which 24 (65%) were male and 13 (35%) were female. All presented with fever, and 13 (35%) also had abdominal pain. The risk factors, microbiological examination, interventional management and final diagnosis are given in Tables I-IV.

DISCUSSION

An important consideration for a splenic abnormality in a patient with unexplained fever is a splenic abscess, which classically presents with fever, abdominal pain and leucocytosis. Prior to the advent of ultrasonography and CT, it was very difficult to make the diagnosis. In the pre-antibiotic era, the disease had a high mortality with the abscess being discovered at autopsy. If untreated, a splenic abscess is invariably fatal[1]. Splenic abscess usually follows haematogenous dissemination of infection to the spleen but may occur with infection of a splenic infarct or spread of infection from adjacent organs. Although regarded as a rare condition, splenic abscess is now being seen with increasing frequency due to the use of immunosuppressive agents, treatment with chemotherapy, especially for leukaemia, patients having HIV and intravenous drug abusers who often have concomitant endocarditis[2,3].

The diagnosis of splenic abscess was made by microbiological examination of the spleen by aspiration or post-surgery, and a positive blood culture. In some patients who had no microbiological culture, the diagnosis was made by signs and symptoms of abdominal infection with CT findings consistent with an abscess, although the gold standard for diagnosis would be biopsy or aspiration of the spleen or splenectomy. The clinical presentation of splenic abscess is non-specific, making the diagnosis difficult. The patients in this series all had fever but other signs and symptoms, such as abdominal pain, splenomegaly, leucocytosis and raised erythrocyte sedimentation rate (ESR), were inconsistant. Abdominal pain was only present in about a third

of patients in the present series, which accords well with the findings reported by Symrniotis et al[4].

CT is the most accurate modality for imaging the spleen and CT of the abdomen was used to investigate those patients with unexplained fever[5]. The CT finding of an abscess is a low attenuation area with an enhancing rim when intravenous contrast is given, and gas may be seen in the lesion. Abscesses may be unilocular, multilocular or multifocal, but it is often not feasible to predict the infecting organism on the basis of the CT appearances (Fig. 1).

The causative organisms responsible for splenic abscess differ in the various reported series. In Southeast Asia, melioidosis must always be considered although it only accounted for four (14%) of the abscesses in the current series. In a recently reported series of 60 cases of splenic abscess from the neighbouring country of Thailand, Sangchan et al[6] found melioidosis in 24 (40%) of patients. In a review of 287 cases of splenic abscess reported in the English literature between 1987 and 1995, Pseudomonas species, which would include melioidosis, was found in 16 (6%) of patients[7]. Melioidosis is caused by the gram negative bacillus *Burkholderia pseudomallei*, previously known as *Pseudomonas pseudomallei*. Infection is thought to occur from the soil, and the disease varies from a subclinical infection to a fulminating disease with multi-organ involvement. Lung consolidation is common but there may be abscess formation in any organ[8]. Abscesses in the spleen are commonly multiple (Fig. 2). Melioidosis is regarded as an environmental and occupational hazard in parts of Thailand, and with increasing worldwide travel and migration, patients may present in non-endemic countries[9]. The USA has expressed concern that melioidosis could be used as a bio-warfare agent[10].

Diabetes mellitus is an important risk factor for splenic abscess and in the current series, all four patients with melioidosis were diabetic. Apart from melioidosis, the other diabetic patients in the current series had a range of infecting organisms. Other important risk factors for splenic abscess include endocarditis and several of these patients are intravenous drug abusers; a feature emphasised by many series. Patients with endocarditis are at risk for splenic abscess and the reasons advanced for this include septicaemia, an infarct which subsequently becomes infected, or a septic embolus from an infective focus on the heart valves[11]. The term septic embolus and splenic abscess are often used synonymously. In a series of 564 patients with endocarditis, Robinson et al[12] found a splenic abscess in 27 (4.7%) Kim et al[13] found a splenic lesion in 21%

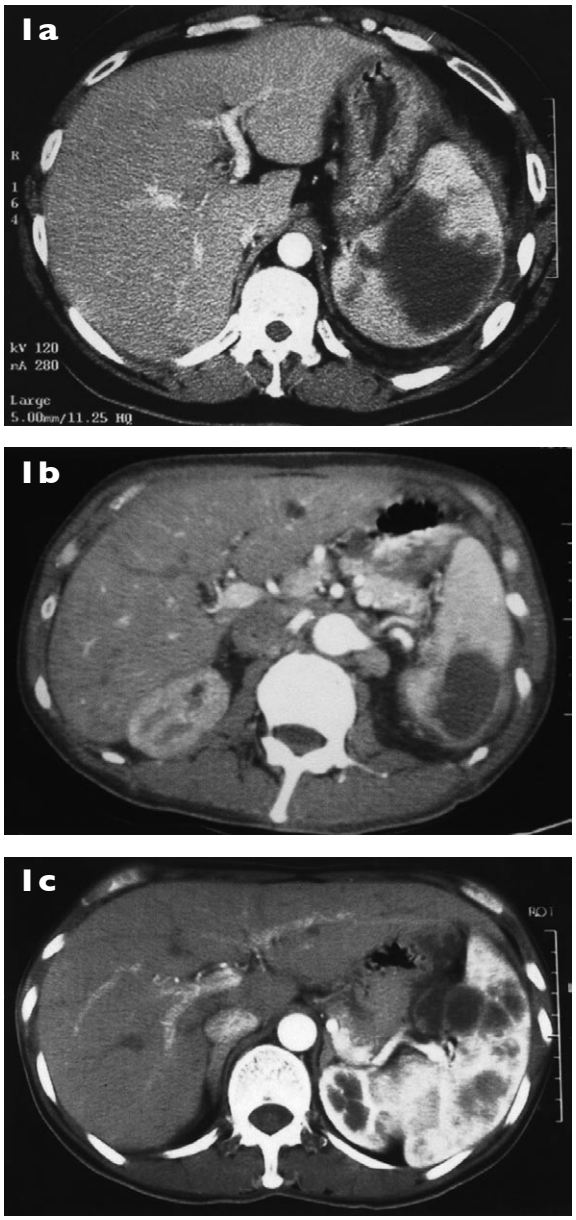

Fig. 1 Splenic abscess appearing as low-attenuation areas in CT images of the spleen. (a) Klebsiella: patient with leukaemia. (b) Salmonella: patient on steroid therapy for haemolytic anaemia. (c) Tuberculosis: patient with leukaemia. Acid-fast bacilli were found in sputum.

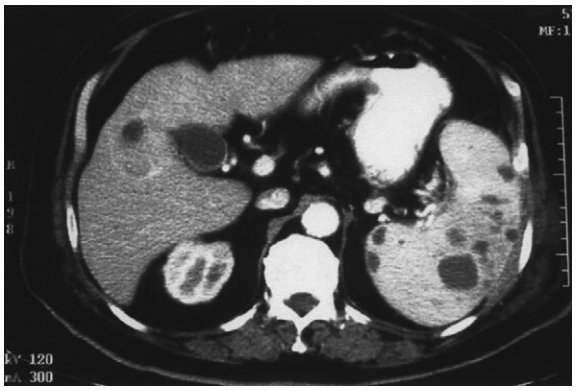

Fig. 2 Melioidosis. CT image of the spleen shows multiple abscesses in a diabetic patient. Pus was aspirated from the spleen. Splenectomy and percutaneous drainage of a liver abscess were performed.

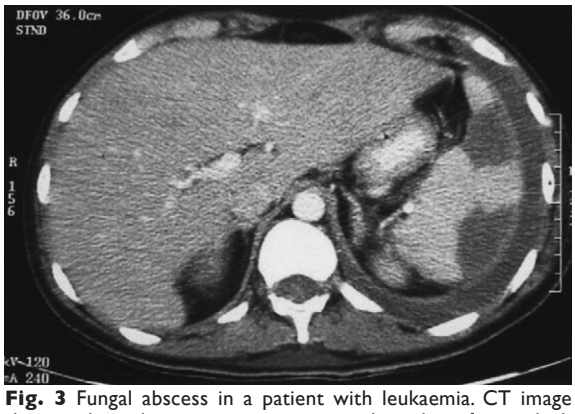

Fig. 3 Fungal abscess in a patient with leukaemia. CT image shows a large low-attenuation area in the spleen from which fungal hyphae were isolated. Splenectomy was performed after unsuccessful percutaneous drainage.

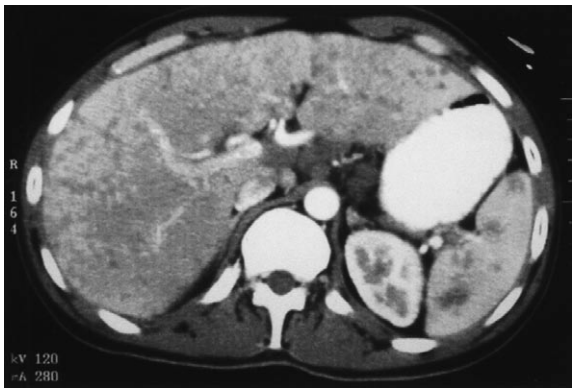

Fig. 4 Fungal abscess. CT image shows multiple low-attenuation areas in the liver and spleen due to Aspergillosis in a patient with no risk factors. Numerous cavitating lung lesions were present as well.

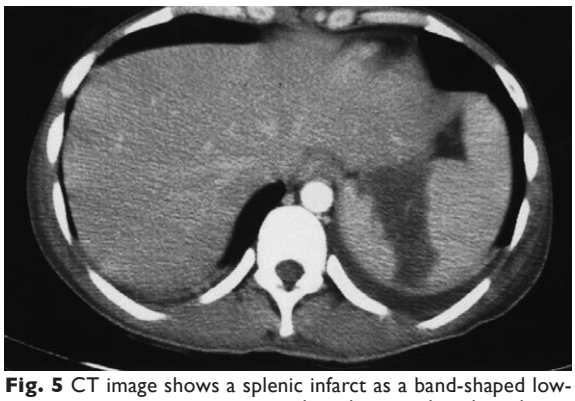

Fig. 5 CT image shows a splenic infarct as a band-shaped low-attenuation area in an intravenous drug abuser with endocarditis.

of patients with multivalvular endocarditis although no distinction was made in the study between abscess and infarction. In the present series, ten patients had endocarditis with the causative organism being *Staphylococcus aureus* or Streptococcus isolated on blood culture.

Immunodeficiency is an important cause of splenic abscess and this includes patients with HIV infection, organ transplantation, steroid therapy and chemotherapy. Schinina et al[14] found focal splenic lesions in 66 out of 2,478 patients (2.6%) with acquired immunodeficiency syndrome (AIDS) and found that *Mycobacterium tuberculosis* was the commonest infecting organism. Fungal abscesses occur in patients undergoing chemotherapy particularly for leukaemia (Fig, 3). Fungal abscesses are often small and multiple, and it can be difficult to isolate the fungi. Multiple small low attenuation areas in patients with leukaemia are presumed to be fungal abscesses, even if cultures are negative (Fig. 4)[15]. An infecting organism could not always be isolated, which occurred in ten (27%) patients in the present series. This could be explained by the fact that the splenic abnormalities were non-infected infarcts, prior antibiotics may have been given, and fungi can be difficult to isolate.

A wedge-shaped low-attenuation area on enhanced CT suggests an infarct which occurs when vascular occlusion produces parenchymal ischaemia (Fig. 5). The clinical presentation of fever and abdominal pain can be similar to that of an abscess. The differentiation of abscess and infarct can be difficult with imaging, but most of the patients had endocarditis and were already receiving antibiotic treatment. It has been suggested on pathophysiological examination that a continuum exists between abscess and infarct, with splenic involvement in approximately 35% of patients with endocarditis[16]. Splenic infarction occurs in a number of conditions, most commonly haematological disorders such as sickle cell disease, leukaemia, myelofibrosis, lymphoma and endocarditis[17]. In the present series, infarction was seen in five patients with endocarditis and one with myelofibrosis. Splenic infarcts may resolve but may rupture. Alternatively, splenic infarcts may become infected. This is prone to occur in endocarditis, and is thought to be due to sustained bacteraemia or further seeding with infected emboli from the heart valves. Jaroch et al[18], in a series of 77 patients with splenic infarct from all causes, found that an abscess developed in 19 (25%) cases.

The surgical literature has stressed splenectomy as the treatment for surgical abscess[19]. However, with the awareness of the value of conserving the spleen, antibiotic treatment and if the abscess is large enough, percutaneous drainage under CT or ultrasound guidance could be undertaken[20,21]. Surgery may be appropriate for those abscesses that are multiple or multilocular, but administration of the appropriate antibiotic and percutaneous drainage is now the first line of treatment. In the present

Fig. 6 CT image shows a non-homogeneous area in the spleen which proved to be lymphoma on biopsy. No lymphadenopathy was present.

series, percutaneous drainage was performed in six patients; however, in two patients, this was not successful and splenectomy was subsequently performed. Serial CT scans can monitor the progress of percutaneous drainage and effectiveness of antibiotic treatment although assessment of follow-up scans was not addressed in this study.

The serious complication of both splenic abscess and infarct is rupture of the spleen, in which case surgery is mandatory. Not all splenic lesions in patients with fever are abscesses or infarcts. Lymphoma can present as a fever of unknown origin, and lymphoma may have a primary presentation just in the spleen though other sites are often involved as well[22,23]. Three patients, one with HIV, had an attempted splenic aspiration followed by biopsy which proved to be lymphoma, stressing the need for further investigation of splenic masses by aspiration for microbiological culture or biopsy (Fig. 6).

In conclusion, a splenic abscess must be considered in patients presenting with unexplained fever and a focal abnormality in the spleen. It is important to recognise the risk factors, particularly diabetes mellitus and endocarditis. Various micro-organisms may be responsible but in Southeast Asia, melioidosis must be considered. Antibiotics and percutaneous drainage are being used as the first line of treatment, with splenectomy if this treatment fails. Splenic infarct and lymphoma can present in a similar manner to an abscess.

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