

Retrospective review of clinical presentations, microbiology, and outcomes of patients with psoas abscess

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Objective The clinical features of patients with psoas abscess in a local setting, including the microbiology, incidence and aetiologies, have not been well described. This study aimed to review such clinical features and patient outcomes.

Design Retrospective case series.

Setting Regional hospital, Hong Kong.

Patients Adults (aged ≥ 18 years) with psoas abscess admitted to Tuen Mun Hospital from 1 January 2006 to 31 December 2010 were included. The clinical presentations, aetiologies, microbiology, treatments, hospital stays, intensive care unit admissions, and outcomes of these patients were reviewed.

Results The series entailed 42 patients, five of whom developed their psoas abscess after admission and seven were intravenous drug abusers. The most common presenting symptom in community-onset cases was back, hip, or thigh pain (43% [16/37]). Fever was present at presentation in 41% (15/37) of these patients, four of whom presented with fever only. The diagnosis was made by computed tomography in 95% (40/42) of these cases. In all, 23 abscesses were considered secondary; the most common aetiology being infective spondylitis or spondylodiscitis. The commonest causative organism for a primary psoas abscess was methicillin-sensitive *Staphylococcus aureus*, while for secondary abscesses they were more commonly from the gastro-intestinal and genitourinary tracts. Overall in-hospital mortality rate was 14% (6/42). Secondary psoas abscess patients had longer hospital stays (mean, 62 vs 34 days; $P=0.007$).

Conclusion Psoas abscess is an uncommon condition. Most patients presented with only non-specific symptoms leading to difficulty in making an early diagnosis. In more than half of these patients, the psoas abscesses were secondary, the aetiology of which differed from reported overseas experience.

Key words

Discitis; Muscles; Psoas abscess; Sepsis; Spondylitis

Hong Kong Med J 2013;19:416-23
DOI: 10.12809/hkmj133793

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New knowledge added by this study

- About half of all local patients with a psoas abscess had a secondary cause.
- The most common aetiology for a secondary psoas abscess was infective spondylitis (or spondylodiscitis), in which the finding differed from overseas experience.

Implications for clinical practice or policy

- Patients with psoas abscess commonly present with non-specific symptoms leading to difficulties in making an early diagnosis.

Introduction

Psoas abscess is an uncommon but dangerous condition. The high susceptibility of the psoas muscle to infections is related to its unique anatomy; organisms can access the muscle by either direct extension or via haematogenous seeding. The psoas muscle originates from the lower thoracic and all the lumbar vertebrae (lateral borders of T12 to L5), and extends through the pelvic retroperitoneum and over the pelvic brim to insert onto the lesser trochanter of the femur. Thus, it lies in close proximity to a number of retro- and intra-abdominal organs, including the kidneys, ureters, pancreas, appendix, and large and small intestines. Organisms from these organs could spread directly to the psoas

muscle. Moreover, the abundant blood supply of the muscle is believed to be a predisposing factor for haematogenous spread from distant sources.¹ The clinical presentation is usually insidious. The classical clinical triad—fever, back pain, and flank or groin mass—only ensues in a minority of patients. Treatment consists of adequate drainage either percutaneously or surgically, coupled with prompt antibiotic therapy. Serious complications such as sepsis and even mortality could result from delay in diagnosis. The presence of co-morbidities is also associated with a poor prognosis. Psoas abscess is traditionally classified into primary or secondary depending on the presence or absence of an identifiable infectious focus in an adjacent structure. Previous studies showed a high prevalence of primary psoas abscess in Asia.² In 1966, Lam and Hodgson³ published a local study involving 24 patients with primary psoas abscess treated in Queen Elizabeth and Queen Mary hospitals between 1961 and 1965, all of which ensued despite exclusion of pelvic, retroperitoneal, and thoracic infections. Regarding locally encountered primary and secondary psoas abscesses, possible aetiologies and involved microbes have not been well described.

Methods

All clinical data were retrieved from the hospital electronic record database, as well as the Clinical Data Analysis and Reporting System that is a computerised data retrieval system of the Hong Kong Hospital Authority.⁴ The diagnosis of psoas abscess (ICD-9 coding 728.89) under the categories of “any diagnoses” was searched. All patients with a psoas abscess admitted into Tuen Mun Hospital between the period of 1 January 2006 and 31 December 2010 were included. This hospital has around 2000 beds serving Tuen Mun New Town and northwest regions of the New Territories in Hong Kong. Patient inclusion criteria were: (1) established diagnosis of a psoas abscess by (a) computed tomography (CT) or magnetic resonance imaging (MRI) or (b) surgical drainage; (2) aged 18 years or above; and (3) availability of complete clinical records for review. Patients were excluded if the diagnosis was only based on clinical suspicions in the absence of imaging and/or operative confirmation. Clinical presentations, including symptoms and signs and their duration, microbiology, underlying pathologies, treatments offered, and outcomes were reviewed from the clinical records. The entire study was approved by the institutional review board at the New Territories West Cluster of the Hospital Authority.

In this study, a primary psoas abscess was defined as occurring without an identifiable source of infection outside the psoas muscle, while it was considered secondary if there was a contiguous

腰肌膿腫患者的臨床表現、微生物學和治療結果的回顧研究

- 目的** 本地並沒有關於腰肌膿腫患者臨床特徵的詳細闡述，包括其微生物學、發病率和病因。本研究回顧這些患者的臨床表現和治療結果。
- 設計** 病例系列回顧。
- 安排** 香港一所分區醫院。
- 患者** 研究對象包括從2006年1月1日至2010年12月31日期間，所有入住屯門醫院並有腰肌膿腫的18歲或以上成年人。翻查這些病人紀錄以找出有關的臨床表現、病因、微生物學、治療、住院情況、入住深切治療部的次數和治療結果。
- 結果** 42名患者被列入研究範圍，其中5人入院後出現腰肌膿腫，另7人為靜脈注射吸毒者。社區發生的病例中，最常見的症狀為背部、臀部或大腿疼痛（43%；16/37）。有41%（15/37）的患者病發時有發燒，其中4例只出現發燒症狀。95%（40/42）的病例是由電腦斷層掃描確診。有23例屬繼發性，最常見的病因是感染性脊椎炎或椎間盤炎。原發性腰肌膿腫最常見的致病微生物為耐甲氧西林敏感的金黃色葡萄球菌，而繼發性腰肌膿腫的致病微生物大多來自胃腸道和泌尿生殖道。醫院的總死亡率為14%（6/42）。出現繼發性腰肌膿腫的患者住院期較長（平均期：62天比34天；P=0.007）。
- 結論** 腰肌膿腫很罕見。大多數病人的症狀並無特異性，令醫生難以作出早期診斷。超過一半以上的患者屬繼發性，而他們的病因與其他國家文獻記載中的不同。

infectious focus in an adjacent structure (eg vertebra, intestine, kidney, and abdominal aorta).¹ Sepsis was defined according to the definition by the American College of Chest Physicians/Society of Critical Care Medicine Consensus Conference.⁵

Statistical analyses

The Statistical Package for the Social Sciences (Windows version 19.0; SPSS Inc, Chicago [IL], US) was used for all analyses. Descriptive statistics were used to summarise patient demographics. Univariate analysis was performed with the Fisher's exact test for comparison of proportions and Student's *t* test for comparison of means. Independent risk factors for mortality were evaluated by multivariate analysis and a P value of <0.05 was considered statistically significant.

Results

Patient characteristics

In all, 49 patients with a psoas abscess occurring during the study period were identified, seven of whom were excluded for one or more reasons: wrong ICD-9 coding (n=5); incomplete clinical

TABLE 1. Patients who developed a psoas abscess after admission*

Pa-tient No.	Age (years)	Sex	Background	Clinical course	Treatment	Outcome
1	77	M	BPH, HT, old CVA	Admitted for left knee septic arthritis with operation done. Developed lower limb weakness during hospital stay. CT/MRI of lumbar spine showed infective spondylodiscitis of L4/L5 and bilateral psoas abscesses	CT-guided drainage	Discharge
2	76	F	Depression, hepatitis B and C carrier, carcinoma of breast, CVA, BCC of nasolabial fold, HCC	Clinically admitted for radiofrequency ablation of HCC and complicated with recurrent CVA. CT scan of abdomen performed for persistent fever and showed psoas abscess	Conservative management because of small size of abscess	Discharge
3	74	M	DM, AF, cholangiocarcinoma with Whipple operation done	Admitted for biliary sepsis. CT scan showed liver abscess. Follow-up CT scan showed new psoas abscess and resolving liver abscess	Failed CT-guided drainage because of small size of abscess. For conservative management	Discharge
4	66	M	Advanced carcinoma of sigmoid	Palliative total colectomy with ileostomy done. Postoperatively found persistent pus discharge from abdominal drain. CT scan of abdomen showed psoas abscess	CT-guided drainage	Discharge
5	70	F	DM, HT, CVA, carcinoma of sigmoid with liver metastasis	Hartmann's operation for sigmoid carcinoma with intestinal obstruction performed. Leukocytosis and abdominal pain after operation. CT scan of abdomen showed multiple retroperitoneal and intraperitoneal abscesses	CT-guided drainage	Discharge

* BPH denotes benign prostate hyperplasia, HT hypertension, CVA cerebral vascular accident, BCC basal cell carcinoma, HCC hepatocellular carcinoma, DM diabetes mellitus, AF atrial fibrillation, CT computed tomography, and MRI magnetic resonance imaging

records (n=2), aged less than 18 years (n=1); and no imaging or operative confirmation of the diagnosis (n=1). The mean age of the final cohort of 42 cases was 61 (standard deviation, 16; range, 27-96) years. There were 27 males and 15 females; most (88%, n=37)

had one or more additional medical condition. The most common of these were hypertension (n=14), diabetes mellitus (n=13), cardio/respiratory disorder (eg ischaemic heart disease, atrial fibrillation, and chronic obstructive airway disease) [n=7], intravenous drug addiction (n=7), underlying malignancy (n=6), cerebrovascular accident (n=5), and chronic hepatitis (n=4).

TABLE 2. Clinical presentations on admission of 37 community-onset psoas abscess patients*

Clinical presentation	No. of patients
Pain (total)	21 (57%)
Abdominal pain	5 (14%)
Back/hip/thigh pain	16 (43%)
Fever (temperature >38°C)	15 (41%)
Groin/flank mass	10 (27%)
Limited hip movement	8 (22%)
Sepsis	16 (43%)
Hypotension (systolic blood pressure <90 mm Hg)	3 (8%)
Other presenting symptoms	
Decreased general condition	4
Upper gastro-intestinal bleeding with poor diabetes control	1
Left lower limb deep vein thrombosis	1
Shortness of breath/suspected chest infection	2
Duration of symptoms before admission	
Within 1 day	10 (27%)
2-7 Days	17 (46%)
8-14 Days	4 (11%)
1-3 Months	6 (16%)

* Five cases with psoas abscess developed after admission were not included. Four patients presented with fever only. No patients had the classical triad presentation for psoas abscess (fever, back pain, and groin/flank mass)

The underlying malignancies included carcinoma of sigmoid/colon (n=3), liver (n=1), cervix (n=1) and prostate (n=1), and the chronic hepatitis types were B (n=2), C (n=1), and both B and C (n=1). One patient was receiving long-term steroid therapy for rheumatoid arthritis and another was on chemotherapy for colonic carcinoma. None of the patients had liver cirrhosis, human immunodeficiency virus (HIV) infection, a haematological malignancy, or inflammatory bowel disease. Regarding the patients with diabetes mellitus, in nine of them the mean value of their latest recorded glycosylated haemoglobin (HbA1c) level before admission was 10.7% (range, 6.6-15.9%); HbA1c levels of four patients were not available.

Clinical presentations

Five patients developed their psoas abscess after admission, their presenting features on admission being unrelated to their abscess. Details about these five cases are summarised in Table 1, while the clinical presentations on admission in the remaining 37 cases are summarised in Table 2. Among the community-onset psoas abscess patients, 18 were initially admitted to the medical unit, 13 to the

orthopaedic unit, and five to the surgical unit; one patient was directly admitted into the intensive care unit for management of septic shock. Around half of the patients (43% [16/37]) presented with back, hip or thigh pain, and 14% (5/37) with abdominal pain. Fever was present in 41% (15/37) of these patients, four of whom only had fever at presentation. A groin or flank mass, and limited hip movement were detected in about one fourth and one fifth of the patients, respectively. No patient presented with the classical triad (fever, back pain, and groin or flank mass). There was evidence of sepsis in 43% (16/37) of the patients and 8% (3/37) had hypotension on presentation.

Diagnosis

In 95% (40/42) of the cases the diagnosis of psoas abscess was made by CT, in one patient it was confirmed by MRI, and in another it was diagnosed intra-operatively. Bilateral psoas abscesses were detected in eight patients, whilst 34 had unilateral psoas abscesses (right-sided, n=18 and left-sided, n=16).

Aetiology and microbiology

The culture results are summarised in Table 3. Presence of pus and positive blood cultures were found in 27 and 15 patients, respectively. The most common organism cultured in both blood and pus was methicillin-sensitive *Staphylococcus aureus* (MSSA), whereas methicillin-resistant *Staphylococcus aureus* (MRSA) was cultured from both the pus and blood of two patients. One of whom had enjoyed good past health without any recent hospitalisation or medical procedure, but the other had endured

multiple medical illnesses and had been recently hospitalised. Secondary psoas abscesses were most commonly associated with infective spondylitis or spondylodiscitis (n=9). Other identifiable causes included septic arthritis of hip (n=3), osteomyelitis of vertebral bodies (n=1), pyogenic sacroiliitis (n=1), infected carcinoma of colon (n=3), infected peritoneal metastasis (n=1), liver abscess (n=1), infected carcinoma of the cervix (n=1), pyonephrosis (n=1), mycotic abdominal aneurysm (n=1), and suspected retained foreign body (n=1). The Figure shows the radiological features of four illustrative cases with secondary psoas abscesses.

Psoas abscesses due to *Mycobacterium tuberculosis* infection

There were six patients with psoas abscess due to tuberculosis infection (mean age, 54; range, 32-96 years), five of whom were admitted via the emergency department. The remaining patient had had a tuberculosis psoas abscess 3 years earlier and was found to have recurrence at follow-up, for which she was admitted and had surgical drainage. Four patients presented with a groin or flank mass, only two of whom had fever on presentation. Pus and wound swab cultures were negative for other bacteria in all of the cases. The initial acid-fast bacillus smear was positive in only one patient, but all six had culture-positive psoas pus. In addition, the sputum of one patient was culture positive for *M tuberculosis*, and another had *M tuberculosis* cultured in a gastric aspirate. Two out of the six patients were considered to be primary and other four were regarded as secondary infections from the spine (n=3) and hip (n=1). One (17%) of these six patients died.

TABLE 3. Microbiology of the 42 patients with psoas abscesses

Microbiology	Primary (n=19)	Secondary (n=23)
Unknown*	5	10
Monomicrobial†	12	11
MSSA	5	3
MRSA	2	-
<i>Mycobacterium tuberculosis</i>	2	4
Enterobacteriaceae‡	3	2
<i>Streptococcus agalactiae</i>	-	1
Bacteroides species	-	1
Polymicrobial	2	2
<i>Streptococcus milleri</i> and <i>Prevotella intermedia</i>	1	-
MSSA, <i>Pseudomonas aeruginosa</i> and <i>Peptostreptococcus</i> species	1	-
<i>Escherichia coli</i> and <i>Klebsiella</i> species	-	1
<i>Escherichia coli</i> , <i>Klebsiella</i> species, and alpha-haemolytic <i>Streptococcus</i>	-	1

* Because cultures were not obtained (n=6) or were negative (n=9)

† MSSA denotes methicillin-sensitive *Staphylococcus aureus*, and MRSA methicillin-resistant *Staphylococcus aureus*

‡ Including *Escherichia coli* (n=2), *Klebsiella pneumoniae* (n=2), and *Proteus mirabilis* (n=1)

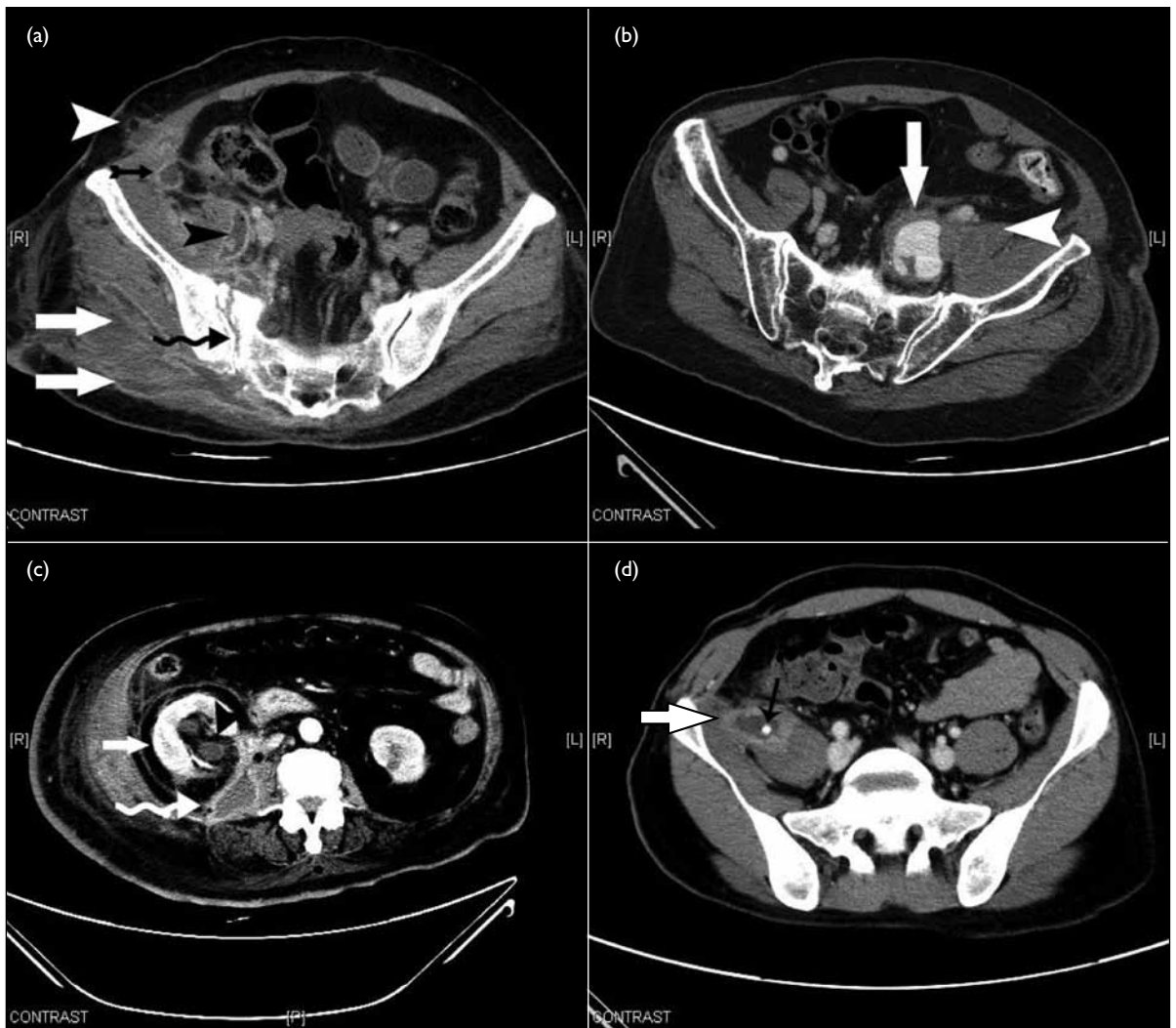


FIG. Radiological features of four cases with secondary psoas abscesses

(a) A 51-year-old woman with a history of diabetes mellitus presented with septic shock and group B streptococcal bacteraemia. Multiple abscesses involving the abdominal wall (white arrowhead), right iliac (black arrow), right psoas (black arrowhead), and right gluteal muscles (white arrows) are revealed by computed tomography (CT). Erosion over the right sacroiliac joint (curved black arrow) is evident. She eventually recovered after repeated drainage of the abscess. (b) A 78-year-old man, with *Salmonella* septicaemia and left lower limb deep vein thrombosis, in whom CT shows a left internal iliac artery mycotic aneurysm (white arrow) with a left psoas abscess (white arrowhead). Ligation of the mycotic aneurysm with a femoro-femoral bypass procedure and surgical drainage of abscess were performed. The patient was subsequently discharged from hospital, taking lifelong antibiotic prophylaxis. (c) A 73-year-old woman admitted for persistent fever; whose CT abdomen shows a distal ureteric stone (not shown) causing right hydronephrosis and suspected pyonephrosis (black arrowhead). Peri-renal fat stranding (white arrow) and a large right psoas abscess with internal gas locules (curved white arrow) are present. The patient eventually died of uncontrolled sepsis. (d) A 28-year-old male with a history of appendectomy 4 years ago presented with right lower quadrant pain. A right psoas abscess (large white arrow) was revealed by CT together with a metallic density inside the collection (small black arrow). A retained foreign body from the previous operation was suspected. The patient was treated using CT-guided drainage and the abscess resolved

Psoas abscess in intravenous drug abusers

Among our patients there were seven intravenous drug abusers; six were considered to have a primary (haematogenous) psoas abscess and the other was regarded as secondary to left hip septic arthritis. Pus cultures yielded MSSA in six of them, including the patient with a secondary psoas abscess. The other patient had *Streptococcus milleri* and *Prevotella intermedia* cultured from the pus. Among the six patients with MSSA infections, five had only this organism grown from pus; the remaining patient was

also culture positive for *Pseudomonas aeruginosa*, and *Peptostreptococcus* species. All six patients with positive pus cultures of MSSA also had MSSA bacteraemia.

Treatment and outcomes

Five patients received antimicrobial treatment only and 37 also underwent drainage (CT-guided [n=23], ultrasound-guided [n=4], and operative [n=10]). The mean duration of antimicrobial therapy for the pyogenic infections was 61 (standard deviation, 34)

days (excluding one patient with a psoas abscess secondary to *Salmonella* arteritis who was offered lifelong antibiotic therapy).

Except for one in-hospital fatality, patients with tuberculous psoas abscesses received anti-tuberculosis therapy for 9 months to 1 year. Their mean length of hospital stay was 49 (range, 8-183) days. Six (14%) of the patients were admitted to the intensive care unit.

Overall in-hospital mortality rate was 14% (6/42). One patient was complicated by deep vein thrombosis and a sudden cardiac arrest during the hospital stay. Two patients died of uncontrolled sepsis; one who had a poor premorbid state was treated conservatively after discussion with patient's family, another died of nosocomial multidrug resistant *Acinetobacter* infection. Yet another patient had a terminal malignancy and died of disseminated tuberculosis infection. The mean duration of hospital stay was significantly longer for patients with a secondary psoas abscess (62 vs 34 days; P=0.007 [Table 4]). The mean age of the survivors was lower than that of those who died but the difference was not statistically significant (58 vs 76 years; P=0.063). Primary psoas abscesses appeared to be associated with higher mortality but not to the extent of statistical significance (26% vs 4%; P=0.063 in multivariate analysis). Based on the multivariate analysis, differences between groups in relation to gender, underlying disease (eg diabetes mellitus, cirrhosis, cardiac or respiratory diseases, hepatitis B or C, HIV infection, and malignancy), receipt of immunosuppressants (including steroids), intravenous drug abuse, being chair- or bed-bound, intensive care unit admission, presence of bacteraemia, and causative organisms were not statistically significant independent risk factors for mortality (Table 5).

Discussion

In 1986, Ricci et al² reviewed 367 cases of psoas abscess from the world literature and reported differences in the aetiology worldwide. Thus, 70% (200/286 cases) of primary psoas abscesses occurred mainly in the developing countries, while secondary abscesses appeared exclusively in reports from developed countries including Europe, the United States, and Canada. The most commonly reported aetiology for secondary abscesses was Crohn's disease.² More recent studies also revealed Crohn's disease as the most common aetiology of secondary psoas abscess in overseas countries.^{6,7} Secondary psoas abscesses were reported to be more likely in older patients.² However, this was not evident in the current study.

Primary psoas abscess probably occurs as a result of the haematogenous seeding from an

infectious process in a distant occult source. Other proposed pathogeneses include suppurative lymphadenitis, and trauma with haematoma formation and secondary infection.^{8,9} Medical conditions causing immunosuppression (including diabetes mellitus, HIV infection, receipt of steroids or chemotherapy) are risk factors for a primary psoas abscess.¹ Secondary psoas abscess is caused by the spread from an adjacent infectious process. In contrast to data from overseas studies, in this study spondylitis (spondylodiscitis with disc involvement) was found to be the most common aetiology of secondary psoas abscess, and no cases were deemed related to Crohn's disease. Spondylitis is an infrequently encountered condition and is the main manifestation of haematogenous osteomyelitis in middle-aged patients (>50 years old), with *S aureus* as the predominant pathogen.¹⁰ In this study it was also found to be the causative organism in two of the nine patients with psoas abscess secondary to spondylitis or spondylodiscitis; the remaining seven cases included two with *M tuberculosis*, one with *Escherichia coli*, and four with no growth. Pyogenic sacroiliitis,¹¹ infection of a kidney,¹² and aortic infection¹³ are uncommon aetiologies of psoas abscess. Predisposing factors for pyogenic sacroiliitis include intravenous drug abuse and trauma. As in spondylitis, *S aureus* is also the most common causative organism of pyogenic sacroiliitis.¹⁴ Group B *Streptococcus* (*S agalactiae*) is an important pathogen causing neonatal meningitis and sepsis. Rare cases of sacroiliitis due to this organism have also been reported.¹⁵ Mycotic aneurysm is a rare but

TABLE 4. Comparison of clinical features and outcomes in primary and secondary psoas abscess patients

Clinical feature/outcome	No. (%) or mean ± standard deviation		P value
	Primary (n=19)	Secondary (n=23)	
Mean age (years)	64 ± 17	59 ± 16	0.34 [†]
Underlying medical illnesses			
Diabetes mellitus	7 (37)	6 (26)	0.453 [‡]
Underlying malignancy	2 (11)	4 (17)	0.427 [‡]
Long-term steroid use	0 (0)	1 (4)	0.358 [‡]
On chemotherapy	0 (0)	1 (4)	0.358 [‡]
Bed-/chair-bound	3 (16)	3 (13)	1.00 [‡]
Bacteraemia*	9 (53)	7 (39)	0.404 [§]
Intensive care unit admission	3 (16)	3 (13)	1.00 [‡]
Mean length of hospital stay (days)	34 ± 17	62 ± 40	0.007 [†]
Mortality	5 (26)	1 (4)	0.075 [‡]

* 7 Cases did not have blood culture performed including 2 cases with primary psoas abscess and 5 cases with secondary psoas abscess

[†] Pair t test

[‡] Fisher's exact test

[§] Chi squared test

TABLE 5. Analysis of mortality by univariate and multivariate analyses

Characteristic*	No. (%) or mean \pm standard deviation		P value (univariate analysis)	P value (multivariate analysis)
	Alive (n=36)	Death (n=6)		
Age (years)	58 \pm 16	76 \pm 16	0.015 [‡]	0.063
Sex			0.649 [§]	0.311
Male	24 (67)	3 (50)		
Female	12 (33)	3 (50)		
Underlying diseases				
Diabetes mellitus	11 (31)	2 (33)	1.000 [§]	0.222
Cirrhosis	0 (0)	0 (0)	-	-
Cardiac or respiratory diseases [†]	6 (17)	1 (17)	1.000 [§]	0.441
Hepatitis B or C	4 (11)	0 (0)	1.000 [§]	0.499
HIV	0 (0)	0 (0)	-	-
Malignancy	5 (14)	1 (17)	1.000 [§]	0.411
On immunosuppressants (chemotherapy or steroid)	2 (6)	0 (0)	1.000 [§]	0.646
Intravenous drug addiction	6 (17)	1 (17)	1.000 [§]	0.653
Chair-/bed-bound	4 (11)	2 (33)	0.197 [§]	0.411
ICU admission	4 (11)	2 (33)	0.197 [§]	0.282
Aetiology of psoas abscess			0.075 [§]	0.063
Primary	14 (39)	5 (83)		
Secondary	22 (61)	1 (17)		
Bacteraemia	13 (36)	3 (50)	1.000 [§]	0.448
No blood culture	7 (19)	0 (0)		
Microbiology aetiology			0.316 [§]	0.209
MSSA	7 (19)	2 (33)		
MRSA	2 (6)	0 (0)		
Gastro-intestinal/genitourinary tract bacteria	9 (25)	0 (0)		
<i>Mycobacterium tuberculosis</i>	5 (14)	1 (17)		
Negative	10 (28)	0 (0)		
No pus culture	3 (8)	3 (50)		

* HIV denotes human immunodeficiency virus, ICU intensive care unit, MSSA methicillin-sensitive *Staphylococcus aureus*, and MRSA methicillin-resistant *Staphylococcus aureus*

[†] They include ischaemic heart disease, atrial fibrillation, and chronic obstructive airway disease

[‡] Student's *t* test

[§] Fisher's exact test

potentially life-threatening condition. Most reported cases of psoas abscesses related to aortic infection were caused by *Salmonella* infection.¹³ Transient bacteraemia occurs in less than 10% of patients with non-typhoid *Salmonella* infection.¹⁶ *Salmonella* bacteraemia, which particularly infects structurally abnormal vasculatures (eg with atherosclerosis), causes necrosis of the intima in a pre-existing aneurysm. Elderly patients are therefore particularly prone to endovascular infection owing to the higher frequency of atherosclerotic disease, with the abdominal aorta being the most frequently affected.¹⁷

When compared with primary psoas abscesses, secondary abscesses are reported to have a higher mortality.² In this study, however, primary abscess was associated with higher mortality. This could be explained by the higher frequency of infective

spondylitis or spondylodiscitis as the underlying cause, which is known to have a low mortality rate. Nevertheless, patients with secondary psoas abscesses had longer hospital stays for the treatment of their underlying pathologies.

Psoas abscesses are frequently missed at initial presentation. Most patients in this series presented with musculoskeletal (back, hip, or flank) pain, without fever; none had the classical triad of fever, back pain, and a groin or flank mass. Although enlargement and loss of definition of psoas muscle shadow in plain radiographs are clues,¹⁸ these are insensitive features. It has been reported that ultrasonography can help make an early diagnosis of a psoas abscess in the emergency department. Sonographic clues include asymmetrical swelling, focal low density, fluid collection, difficulty defining the muscle, and taken

together these attributes warrant further imaging.¹⁹ Accurate CT imaging can delineate the pathological process in the psoas muscle and clearly demonstrate any co-existing causative retro- or intra-peritoneal disease. The most common CT feature is a focal hypodense lesion within the psoas muscle, though a neoplasm or haematoma in the muscle could give rise to a similar appearance. Presence of gas within the muscle and CT enhancement of the rim of the abscess with contrast are more specific features.²⁰

Treatment of a psoas abscess is based on early use of appropriate antibiotics in conjunction with drainage either percutaneously (guided by imaging) or surgically. Ultrasound-guided drainage has the advantage of easy availability, avoiding exposure to ionising radiation, and real-time monitoring of the entire procedure. However, ultrasound guidance may be limited by suboptimal image quality due to interference from overlying bowel gas, in which case CT guidance is preferable. The latter also provides a more accurate and safe way en-route to the abscess and allows better visualisation of associated pathology in nearby structures. Failure and complication rates related to CT-guided drainage are very low.²¹ Surgery is indicated for failed percutaneous drainage, multi-loculated abscesses or the presence of an underlying

pathological process warranting definitive surgery.

Limitations

This study was a retrospective study and data analysis depended on completeness of clinical data documentation. The statistical power for the analysis of risk factors for mortality was limited by the small number of deaths.

Conclusion

A psoas abscess is a serious infectious condition and usually presents with non-specific symptoms making an early diagnosis difficult, for which a high index of suspicion and prompt treatment are required. The relatively high proportion of secondary psoas abscesses and their aetiological profiles differed from reported overseas experience.

Declaration

This study has been submitted by the first author to The University of Hong Kong for partial fulfilment of the requirement for the Postgraduate Diploma in Infectious Diseases.

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