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Original Article

An Update on Psoas Muscle Abscess: An 8-Year Experience and Review of Literature[†]

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SUMMARY

Background: Psoas muscle abscess is a previously rare disease that has increased in its reported prevalence because of improved diagnostic tools. The literature on psoas muscle abscess mostly consists of case reports and case series.
Methods: We analyzed medical records, such as characteristics, pathogens, and disease pattern, from our hospital in the past 8 years and report nine cases of psoas abscess. We also reviewed the literature for case series and performed a meta-analysis to assess the current characteristics of this disease since 1986.
Results: We reviewed a total of 36 studies, with a total of 682 cases. The average age was 52.6 years, and the mortality rate was 8% (55 of 682). In 35 studies, a total of 274 cases (40.77%) received drainage (274 of 672), whereas 290 (43.15%) received surgery. In 522 cases, the ratio of primary to secondary etiologies was 1:1.71. In 209 cases, *Staphylococcus aureus*, and in 70 cases, *Escherichia coli* were identified as the pathogens from culture data. Compared with Ricci's case series, we found an obvious increase in prevalence of secondary causes (63.2% compared with 21.8%) and higher mortality in recent study (6.7% in Ricci's study and 8.1% in recent study). There was an obvious shift toward drainage as the treatment of choice.
Conclusions: We conclude that a higher mortality has occurred in recent study, and psoas abscess is an infrequent and easily overlooked infectious disease requiring early diagnosis with favorable results with percutaneous drainage.

1. Introduction

Since the first report of acute inflammation of the psoas muscle in the literature by Mynter in 1881[1], psoas muscle abscess has been known as an infrequent, insidious, yet easily overlooked and potentially life-threatening infectious disease. Psoas muscle infection was once in common coexistence with tuberculosis spine infection, but the incidence decreased with the widespread use of standard antituberculosis medications, and pyogenic causes became predominant. The incidence has increased because of the refinement of diagnostic tools, such as widespread use of computerized tomography (CT), but the condition is still regarded as a rare disease even in recent studies[2].

Previous reports of psoas abscess in the medical literature consist of case reports and case series with small case numbers. Ricci et al[3] presented a case series with a case number of 367 in 1986, the largest number of cases so far, which included every case published in the literature at that time[3]. Since then, there has been no similar large, worldwide multicenter case review of psoas abscess, and only case series and reports of various sizes exist. Recently, a comprehensive retrospective case series by Navarro López et al[2] consisted of 124 cases from 11 hospitals in Spain, the largest case number since the report by Ricci[3]. Much has changed since 1986, regarding mortality, diagnostic approach, treatment modalities, and aspects of the disease. In view of the aforementioned point, we sought to conduct an extensive review of the medical literature containing case series after the year 1986 and to examine the current features of the disease. In addition, we included the data from the past 8 years from our institute records. We assessed the pooled data and checked the mortality, gender difference, and age distribution, and discuss in detail specially designed reports. Our study provides an updated evaluation of pooled data of worldwide cases of psoas abscess and may shed

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some light on the current status of the disease and its treatment options.

2. Materials and Methods

2.1. Case records from our institution

From January 2002 to May 2009, nine patients with acute pyogenic psoas abscess were diagnosed according to the medical records database in our hospital. The patient was diagnosed of psoas muscle abscess if one or more of the following was present: (1) clinical presentation of infection with compatible CT finding of abscess in the iliopsoas muscle; (2) percutaneous or surgical drainage proven abscess accumulation at the psoas muscle area. No coexisting tuberculous infection or Cohn's disease was present in any of the cases. The clinical presentation, etiology, location, microbiology, treatment, and outcome were analyzed. We assessed the presence of common risk factors for acute psoas muscle abscess, including old age, sex, diabetes mellitus, hypertension, and other coexisting medical problems. The presence of urinary tract infection was checked. The results are summarized in Table 1.

2.2. Review methods

A search of the PubMed database from 1986 to the present was performed, using the Boolean expression [(Psoas or iliopsoas) and (abscess)]. We excluded single case reports and cases with patients younger than 18 years. We included case series in English language, and case series with non-English language were only included when the information of interest could be derived from the abstract or from the manuscript itself. Because of different characteristics and aspects of interests of each individual case series, we only examined features that were demonstrated in all of the series, including average age, sex distribution, treatment modality (surgical vs. percutaneous vs. antibiotics only), mortality. We discussed case series with special features. The result is summarized in Table 2.

Psoas abscess was classified as primary or secondary. Primary psoas abscesses lacked a definite source of infection[4]. On the contrary, secondary psoas abscesses are identified with an infectious source that may result from direct invasion of nearby infectious site with predisposing by trauma or operation.

3. Results

3.1. Case records from our institution

A review of the medical records database of our hospital revealed nine patients with 11 episodes of radiography- or drainage-confirmed pyogenic psoas abscess. Two patients had a second episode of psoas abscess; recurrence was assumed in one patient as the second episode occurred 1 month after discharge, and culture data yielded same bacteria results. In the other patient with a second event, the two episodes were 6 months apart, and different locations were noted. The first episode was presumed to be secondary to urinary tract infection, whereas the second episode was presumed as primary psoas abscess. For calculation purposes, separate episodes in the same patient were calculated separately. An analysis of the characteristics in the 11 episodes revealed the following: average age was 60.6 years on presentation, the male:female sex ratio was 1:1.75, and the average length of stay was 25.7 days. Five episodes were classified as primary if an origin of infectious source could not be located, whereas six episodes were secondary, all presenting with urinary tract infection. The most

Table 1
Case records from our institution

No.	Sex	Age (yr)	Initial WBC (/mm³)	Initial CRP (mg/dL)	Comorbidity	Location	B/C	Pus culture	Image	Antibiotics	Initial symptoms	Days	Surgery	Drainage	Primary/secondary
1	M	87	11,380	2.59	CHF, CVA	Left	ESBL-KP	ESBL-KP	CT	Piperacillin, meropenem	Abdominal pain, fever	23	N	N	Secondary (urosepsis)
2	M	47	9,300	9.18	HTN, alcoholism	Right	NA	Negative	CT	Penicillin	Back pain, fever	8	N	N	Primary
3	M	47	25,710	32.99	Heroin abuse	Left	MSSA	MSSA	CT	Oxacillin	Left foot pain, fever	23	Y	Y	Secondary (cellulitis)
4	F	71	13,300	25.74	DM	Right	E coli	NA	CT	Levofloxacin	Low back pain, fever	22	N	N	Primary
5	F	71	11,880	2.67	DM, HTN, autoimmune hepatitis	Right	Salmonella typhi	Negative	CT	Ceftazidime→imipenem[b]	Fever, pyuria	46	N	Y	Secondary (UTI)
6	M	69	7,040	8.62	COPD, colon cancer	Left	NA	NA	CT	Ampicillin–sulbactum	General weakness, fever	23	N	N	Secondary (UTI)
7	F	66	16,880	19.48	HIVD	Right	MSSA	MSSA	CT	Ampicillin–sulbactum	Lower back pain, fever, chills	26	N	Y	Primary
7	F		14,810	13.27	HIVD	Right	MSSA	NA	CT	Vancomycin	Lower back pain, fever,	20	N	N	Primary
8	F	33	20,220	22.95	DM	Right	Group B Streptococcus	Negative	CT	Oxacillin	Fever, lower back pain	20	N	Y	Secondary (UTI)
8	F	34[a]	19,900	23.9	DM	Bilateral	NA	Group B Streptococcus	CT	Oxacillin	Fever, lower back pain	36	N	Y	Primary
9	F	76	2,440	19.97	DM	Bilateral	E coli	E coli	CT	Piperacillin	Fever, dyspnea	36	N	Y	Secondary (UTI)

B/C = blood culture; CHF = congestive heart failure; COPD = chronic obstructive pulmonary disease; CRP = C-reactive protein; CT = computed tomography; CVA = cerebrovascular accident; DM = diabetes mellitus; E coli = Escherichia coli; ESBL-KP = extended-spectrum beta-lactamase-producing Klebsiella pneumoniae; HIVD = herniated intervertebral disc; HTN = hypertension; MSSA = methicillin-sensitive Staphylococcus aureus; N = no; NA = not available; No. = number; UTI = urinary tract infection; WBC = white blood cell count; Y = yes.
[a] A second episode in the following year.
[b] Shifted to imipenem because of persistent fever and culture data.

Table 2
Characteristics of care series—meta-analysis

Study	No. of cases	Sex Male (n)	Female (n)	Mortality (n)	Average age (yr)	Drainage (n)	Surgery (n)	S aureus (n)	E coli (n)	Primary (n)	Secondary (n)	Duration of case enrollment
Lai et al[a]	11	4	7	1	60.6	8	1	3	2	5	6	2002–2009
Al-Hilli et al, Ir Med J[6]	3	3	0	0	59	3	1	NA	NA	2	1	NA
Dauchy et al, Acta Orthop[7]	13	9	4	0	70	6	4	5	NA	0	7	2005/1/1–2006/12/31
Kaya and Sayil, Trop Doct[8]	2	1	1	0	48	1	0	NA	NA	0	2	NA
Navarro López, Medicine (Baltimore)[2]	124	86	38	6	58	63	21	23	23	27	97	1990–2004
Charalampopoulos et al, Scand J Gastroenterol[9]	5	4	1	1	70	4	1	2	1	3	2	NA
Yacoub et al, Am J Surg[10]	41	30	11	0	44	26	2	11	NA	18	23	2000–2006
Yadav et al, Kathmandu Univ Med J[11]	36	22	14	1	24.33	0	36	24	NA	NA	NA	2005/2–2006/3
Koffi et al, West Afr J Med[12]	18	8	10	0	35.7	2	16	2	3	15	3	NA
Hammami et al, Tunis Med[13]	38	22	16	1	44	16	9	10	2	10	28	1990/1–2005/12
Hsu and Lin, J Vasc Surg[14]	8	7	1	6	71	0	7	3	2	0	8	1996–2007
Tofuku et al, Spine[15]	12	9	3	1	73.5	12	0	NA	NA	0	12	2003/3–2005/7
Garner et al, Colorectal Dis[16]	15	8	7	0	57	13	0	4	2	6	9	2002/2–2005
Audia et al, Rev Med Interne[17]	6	3	3	0	60	3	1	NA	NA	0	6	NA
Pérez-Fernández et al, Enferm Infecc Microbiol Clin[18]	14	10	4	0	42	8	4	3	3	0	14	1999–2004
Loussaïef et al, Tunis Med[19]	11	8	3	0	27	5	1	6	NA	NA	NA	NA
Hanaoka et al, J Neurosurg Spine[20]	5	5	0	0	76	4	1	2	NA	0	5	2002–2004
Baier et al, Langenbecks Arch Surg[21]	40	19	21	6	54.3	8	32	12	7	10	30	NA
Van den Berge M et al, Neth J Med[22]	12	5	7	2	55	1	6	6	2	5	7	2001/6–2004/6
Cánovas Ivorra et al, Arch Esp Urol[23]	5	4	1	0	48.2	4	0	4	NA	5	0	1985–2000
Hamano et al, Urol Int[24]	17	11	6	3	66.2	3	13	6	3	8	9	1995–2001
Penado et al, Enferm Infecc Microbiol Clin[26]	23	16	7	4	NA	7	9	NA	NA	NA	NA	NA
Afaq et al, Trop Doct[5]	72	NA	NA	0	NA	0	72	45	NA	NA	NA	NA
Melissas et al, Acta Chir Belg[25]	3	2	1	0	43.5	0	3	2	NA	3	0	NA
Dahami et al, Ann Urol Paris[27]	18	11	7	1	35	4	15	10	2	18	0	1990–2004
Chang et al, J Microbiol Immunol Infect[28]	15	8	7	4	53.8	10	5	NA	NA	0	15	1995/7–1999/12
Oliver et al, Clin Microbiol Infect[31]	2	1	1	0	63	1	1	NA	NA	6	5	1998
Huang et al, J Infect[29]	25	7	18	11	64	15	5	4	11	6	19	1988/8–1998/7
Lin et al, J Microbiol Immunol Infect[32]	29	17	12	2	60.3	14	7	10	5	18	11	1993–1998
Lee et al, J Microbiol Immunol Infect[30]	11	3	8	2	53.8	9	2	3	1	6	5	1988/1–1998/5
El Hassani et al, Rev Rhum Engl Ed[33]	16	14	2	0	NA	6	10	7	1	16	0	1987–1997
Laguna and Moya, Enferm Infecc Microbiol Clin[34]	11	NA	NA	1	NA	5	3	2	NA	5	6	1983–1996
Blanco, An Med Interna[35]	6	1	5	0	65.8	NA	NA	NA	NA	NA	NA	NA
Chern et al, Am J Emerg Med[36]	10	8	2	2	64.6	10	2	NA	NA	NA	NA	1993–11/1994/10
Thomas et al, Br J Urol[37]	5	5	0	0	NA	3	0	NA	NA	NA	NA	NA
Total	682	371	228	55	52.59	274	290	209	70	192	330	NA

E coli = Escherichia coli; NA = not available; No. = number; S aureus = Staphylococcus aureus.
[a] Unpublished data; please refer Table 1.

common comorbidity was diabetes, present in four out of nine patients (44.4%). Of the 11 episodes, two were bilateral (22%), with a right:left ratio of 2:1 in the other unilateral episodes. The leading microbiology agent was methicillin-susceptible *Staphylococcus aureus* (27%), and *Escherichia coli* was the second (18%). In two episodes, no culture data could be obtained from blood, urine, or drainage samples, if performed. One case underwent surgery, whereas in six episodes, drainage was performed.

In our series, only one mortality case (Patient 5, Table 1) was reported out of 11 episodes (9%). The patient had an underlying history of diabetes, hypertension, and autoimmune hepatitis, which required her to undergo long-term usage of oral steroids (prednisone 20 mg daily, for more than 10 years). She presented with psoas abscess secondary to urinary tract infection. Empirical antibiotics were initially chosen with ceftazidime, (2 g every 12 hours) to cover fulminant urinary tract pathogens. The patient soon progressed to widespread intra-abdominal infection, which led to respiratory failure and intensive care unit admission. The antibiotics were replaced with imipenem–cilastin (500 mg every 8 hours) for broad-range coverage. Blood culture data revealed infection by *Salmonella typhi*; however, she completed the treatment course with imipenem−cilastatin. Her condition deteriorated and ultimately expired because of profound septic shock despite intensive care. On retrospective, the immunocompromised status and inadequate coverage of antibiotics (as *S typhi* is ideally treated with either ciprofloxacin or ceftriaxone as first choice) might account for poor response to bacterial infection and may contribute to her fatal outcome.

3.2. Review of the literature

We reviewed case series and reports consisting more than one case of psoas abscess reported in PubMed after the year 1986. An initial search of the literature reviewed 51 studies meeting our criteria. We excluded cases consisting of patients younger than 18 years and cases in non-English literature for which details could not be retrieved from either the abstract or the manuscript. We included our institution data from the past 8 years and assessed the cumulative data of the studies. The results consisted of 36 studies, with a total of 682 cases[2,5−37]. The gender distribution was 1.62:1, which consisted of 371 males and 228 females in 34 studies from which the information could be obtained. The average age was 52.59 years in 555 cases. The mortality rate was 8% (55 of 682). In 35 studies, a total of 274 cases (40.77%) received drainage (274 of 672), whereas 290 (43.15%) received surgery. In 522 cases, there were 192 primary cases, with 330 secondary cases (primary: secondary, 1:1.71). In two hundred nine cases, *S aureus*, and in 70 cases, *E coli* were identified as the caustic microorganisms from culture data.

To analyze the change in characteristics since Ricci's case series[3] in 1986, we compared their results with our pooled data (Table 3). We found an obvious increase in the prevalence of secondary causes (63.2% compared with 21.8%). The mortality rate was higher in a recent study (6.7% in Ricci's studyand 8.1% in the recent study).

There was an obvious shift toward drainage as the treatment of choice. Other data are summarized in Table 3.

4. Discussion

Since the study by Ricci et al[3] in 1986, more than 1000 cases have been reported in the medical literature. The mortality of this disease showed a wide variation among different reports, with the highest being 44% in one case series[29], and several case series showed zero mortality[10,12,16]. The statistical significance was limited because of insufficient sample size in most of the reports. In larger series, the mortality was 4.8% in Navarro López et al's series[2] and 0% in Afaq et al's series[5]. In our study, the pooled data showed a mortality rate of 8%, proving that a low mortality can be achieved with current diagnostic and therapeutic techniques.

In the pooled data, 40.77% received percutaneous drainage, and 43.15% received surgical drainage. This demonstrates a vast difference from the study by Ricci in 1986[3], in which surgical incision and drainage were selected as the therapeutic option in 78% (257 of 327). The consensus has shifted to advocate nonsurgical approach as an initial treatment with satisfactory results[2,10,38], consistent with our findings. Compared with Ricci's study[3], there was an increased prevalence of secondary causes. This can be explained by improved diagnostic technique and the recent widespread use of CT. Surprisingly, there was a higher mortality rate (8.1%) despite obvious improvement in medicine than that in Ricci's study[3] (6.7%). The explanation may be the emergence of more virulent multiresistant bacteria and the higher prevalence of secondary causes, which imply a very virulent primary source. Further studies may be needed to validify this result.

An interesting case series was the study by Afaq et al[5], including 72 cases in which all of them received surgery as first-line treatment for psoas muscle abscess, with no mortalities reported. The authors pointed out that surgery was relatively inexpensive (approximately 40 US dollars per operation) in Nepal and carried a safe profile. Another series from the same region also consisted of surgical drainage as the first-line treatment[11] and advocated a standardized doctrine of surgical approach primarily. Because of differences in cost, availability, practice guidelines, and health care policies in individual countries, the practicability of the conclusion in this study remains to be verified.

The microbiological distribution is of great clinical interest, and we tried our best to reproduce the exact results of each study. However, in several studies, the exact percentage of each culture result was not known. In most studies, excluding studies primed toward specific microbiology agents, *S aureus* still predominated in primary causes, whereas *E coli* was the leading agent in secondary causes, presumptively related to high incidence of urinary tract infection in this situation. This finding was not contrary to that of Ricci's original study[3]. A remarkable feature was the high mortality rate in two series from Taiwan[28,29], both showing a high prevalence of *Klebsiella pneumoniae* (24% and 100%) and high mortality (44% and 26%). *Klebsiella pneumoniae*, a frequent infection agent in Orientals and identified as the endemic microbial agent causing

Table 3
Comparison of characteristics between Ricci's study and our meta-analysis

Study	No. of cases	Sex		Mortality	Average age (yr)	Drainage (n)	Surgery (n)	S aureus (n)	E coli (n)	Primary	Secondary
		Male	Female								
Ricci et al (1986)[3]	367	251 (66.5)	116 (33.5)	24 (6.7)	NA	24	328	NA	NA	287 (78.2)	90 (21.8)
Case series (1986−present)[a]	682	371 (54.4)	228 (45.6)	55 (8.1)	52.59	274	290	209	70	192 (36.8)	330 (63.2)

E coli = *Escherichia coli*; NA = not available; No. = number; *S aureus* = *Staphylococcus aureus*.
Data are represented as *n* (%).
[a] Unpublished data; please refer Table 2.

serious morbidity in Taiwan[28], was proposed as an independent factor for mortality in psoas abscess[27]. This finding remains to be validated in further studies.

Our review consisted of case series only, and solitary case reports were excluded from our review. The reason for the study design was that case reports usually reflect a special circumstance or unusual coexisting feature and might not be representative of the generalized clinical picture. Case series, on the other hand, reflects a systemic tracking of a cumulative period of time and in itself carries a certain degree of unbiased randomness. The pooled data revealed results relatively consistent with the large case series by Navarro López et al[2] and may serve as a statistically significant reflection for the current clinical features and treatment of psoas abscess. This meta-analysis provides several important conclusions. First of all, the predominant treatment option has leaned toward nonsurgical drainage primarily since 1986, and the pooled mortality results seem noninferior. The reports from Nepal reflect a distinct approach because of its specific medical environment and economical issues. Furthermore, secondary causes of psoas abscess have increased in prevalence in comparison with those of Ricci's study, probably because of improved diagnostic modalities and physician awareness[38]. *Staphylococcus aureus* and *E coli* remain the leading microbial agents, serving as further reference for antibiotic selection. The low mortality rate may confirm the notion that medical treatment with antibiotics and drainage alone is a reasonable choice for psoas abscess.

Our review is prone to several weaknesses. The pooled data consisted of retrospective data only, and no prospective study was performed, diminishing their evidence level. The difficulty in performing a prospective investigation lies in the low prevalence of this disease. Several case series failed to report every parameter of interest, thus causing possible inaccuracies in the pooled data analysis. Several articles were non-English, thus hindering our data collection. Nonetheless, the case number of the pooled data serves as statistical strength and may serve as a substantial reference value for further clinical practice and investigations.

In conclusion, we reported nine cases from our hospital records in the past 8 years; additionally, we reviewed the literature and pooled 36 case series with a total of 678 cases to conclude an updated result of psoas abscess. The average mortality from the pooled data was 8%. The primary approach chosen for psoas abscess is favored as percutaneous drainage. Significant differences in microbiological characteristics and therapeutic modalities were demonstrated in comparison with those of Ricci's study in 1986. Psoas abscess is an infrequent and easily overlooked infectious disease requiring early diagnosis, and current treatment options using percutaneous drainage may provide favorable results.

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