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Etiology and outcome of iliopsoas muscle abscess in Korea; changes over a decade

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ABSTRACT

Objectives: Iliopsoas muscle abscess (IPA) is considered a rare disease whose etiology has changed depending on the country and antibiotic selection pressure. This study evaluates the changes in etiology, clinical outcome, and risk factors for mortality for IPA.
Methods: We reviewed the medical records of a total of 116 patients with IPA who were admitted to 4 university hospitals in Korea over the 11 years, and compared the etiology between 2001 and 2006 (period 1, $n = 44$) and 2007–2012 (period 2, $n = 72$).
Results: Among 75 cases with a definitive microbial diagnosis, the predominant etiological organisms were *Staphylococcus aureus* (45.3%), followed by *Mycobacterium tuberculosis* (14.7%) and *Klebsiella pneumoniae* (9.3%). The percentage of MRSA in period 2 increased remarkably compared to period 1, from 25% to 44.4%, and incidence of *M. tuberculosis* from 7.1% to 19.1%, although these were not statistically significant. The overall mortality was 6.8% in period 1, and 13.9% in period 2, and sepsis as an initial manifestation (OR 293.5, CI 7.1–12,034.4, $P = 0.003$) and serum creatinine level (OR 0.43, CI 0.23–0.80, $P = 0.008$) were independent predictors of mortality. Invasive procedure improved the prognosis in cases with microbiologic confirmed pyogenic psoas abscess (46/50 [92%] vs. 9/14 [64.3%], $P = 0.008$).
Conclusion: The incidence of MRSA as a cause of IPA is on the increase. Although the overall prevalence of tuberculosis is decreasing, tuberculosis is still an important cause of IPA. Initial clinical status and invasive intervention can lead to favorable outcomes.

1. Introduction

Iliopsoas muscle abscess (IPA) refers to a purulent retroperitoneal collection involving the iliopsoas muscle group.[1] It is a rare disease and there have been reported few data reports on IPA, all of which are small case series. Traditionally, IPA has been characterized as primary IPAs developing through a hematogenous route and secondary IPAs developing after the spread of infection from an adjacent structure. The etiology of IPA may vary with each country and time period.[2] In the pre-antibiotics era, tuberculosis (TB) was one of the most important pathogens in patients with IPA; however the etiology of IPA has changed with the decreasing of prevalence of TB.[1] In our study, we examined the epidemiology, clinical outcome and risk factors for mortality of IPA in Korea over a 11-year period, and compared the etiology of IPA between 2001–2006 and 2007–2012.

2. Materials and methods

We retrospectively reviewed the medical records of patients who were diagnosed with IPA from 4 university hospitals in Korea from January 2001 to May 2012. Patients were included if their radiologic findings, observed using computed tomography or MRI, were compatible with abscess in the psoas muscle, and clinical symptoms and signs were compatible with infection. We analyzed the clinical characteristics, laboratory findings, etiology and outcomes of patients with IPA, and compared with the results between years 2001–2006 (period 1) and 2007–2012 (period 2) year. Primary IPA was defined as IPA resulting from hematogenous spread from an occult source of infection. Secondary IPA was defined as IPA spreading from an adjacent structure such as skeletal, gastrointestinal, genitourinary and skin and soft tissue.[3] The differentiation

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between the primary and secondary was independently confirmed by two infectious disease specialists. Diagnosis of active TB was based on current recommendations.[4] Confirmed TB was defined as positive culture results or PCR results and probable TB as (1) a histological finding on a biopsy, such as caseous granuloma or radiologic findings compatible with TB and (2) successful response to anti-TB medication. Sepsis was defined according to the previous literature.[5]

This study was approved by the institutional review board of the Catholic University of Korea.

3. Statistically analysis

Student's *t*-test was used for analysis of continuous variables, and the chi-squared test or Fisher's exact test was used for categorical variables. We analyzed the risk factors associated with mortality using univariate and multivariate logistic regression analyses. Statistical analysis was performed using SPSS 13.0 and a P value <0.05 was considered statistically significant.

4. Results

A total of 116 patients were enrolled, and the demographic characteristics are shown in Table 1. The mean age was 58.5 ± 1.6 years old, and 53 patients (54.3%) were male. The most common predisposing factor was hypertension (30.2%), followed by diabetes mellitus (29.3%) and malignancy (13.8%). A previous acupuncture history within 3 months prior to admission was apparent in 12.9%. The demographic characteristics were not different between period 1 and period 2. Table 2 shows the distribution of IPA according to origin and the comparison by periods, excluding the TB cases. Forty-one cases (39.0%) were primary IPA and among the 64 cases with secondary IPA, skeletal infections were the most frequent source of infection (n = 22, 34.4%), followed by intra-abdominal infection (n = 21, 32.8%), urinary tract infection (n = 15, 23.4%), skin and soft tissue infection (n = 5, 7.8%) and infected vascular aneurysm (n = 1, 1.6%). Of skeletal origin, spondylitis was the most common diagnosis (n = 14). Secondary IPA was observed more often than primary IPA in both periods, and the percentage of cases with secondary IPA was not different between the 2 periods (27/42 [64.3%] in period 1 vs. 37/63 [58.3%] in period 2, $P = 0.57$).

Positive blood cultures were obtained in 36.8% (42/114) and abscess cultures in 67.1% (49/73). Among 75 cases in which a definitive microbial diagnosis was identified, the predominant etiological organisms were *Staphylococcus aureus* (45.3%, 34/75), followed by *Mycobacterium tuberculosis* (14.7%, 11/75) and *Klebsiella pneumoniae* (9.3%, 7/75). Of the 34 *S. aureus* cases, 35.3% were methicillin-resistant *S. aureus* (MRSA). Fig. 1 shows the comparison of microbial etiology of IPA between period 1 and period 2. Microbiologically undiagnosed cases were 36.4% (16/44) in period 1, and 34.7% (25/72) in period 2. *S. aureus* was the most frequent pathogens in both periods; however the accountable percentage of *S. aureus* in period 2 among microbiologically diagnosed cases had decreased compared with period 1 (57.1% [16/28] vs. 38.3% [18/47]). In particular, MRSA in all *S. aureus* cases had increased remarkably from 25% (4/16, period 1) to 44.4% (8/18, period 2); however this increase was not statistically significant ($P = 0.23$). The incidence of *M. tuberculosis* had increased from 7.1% (2/28, period 1) to 19.1% (9/47, period 2), and was still an important pathogen of IPA until recently, although this changes was not significant ($P = 0.15$).

In patients with primary IPA, *S. aureus* was the predominant pathogen and accounted approximately 47.8% (22/46) of cases. Various organisms including 5 *K. pneumoniae* and 5 *Escherichia coli* were detected in secondary IPA. Of eleven patients with psoas abscess caused by *M. tuberculosis*, 9 cases were diagnosed as having confirmed TB (5 culture and 4 PCR), and 2 as probable TB. Additionally, 5 cases were diagnosed as disseminated TB. Resistance to anti-TB medication was not found in culture-proven cases. The percentage of previous TB exposure was significantly higher in patients with IPA due to *M. tuberculosis* than that due to other pathogens (54.5% [6/11] vs. 6.7% [7/105], $P < 0.001$).

The overall mortality was more slightly higher in period 2 than in period 1; however this difference was not statistically significant (6.8% [3/44] in period 1 vs. 13.9% [10/72] in period 2, $P = 0.24$). Of a total of 13 patients who had died, microbial diagnosis was confirmed in 69.2% (9/13) and *S. aureus* was the leading cause of death in 5 patients. Table 3 shows the comparison of the characteristics between the surviving (n = 103) and deceased (n = 13) patients. Mortality cases received more dialysis as an underlying disease (30.8% vs. 4.9%, $P = 0.001$), showed higher serum creatinine level (2.8 ± 3.4 vs. 1.1 ± 0.8 mg/dl, $P = 0.01$) and C-reactive protein levels (25.0 ± 24.2 vs. 13.2 ± 10.1 mg/dl, $P = 0.01$) than survivor cases. Patients who were admitted to the hospital due to sepsis showed higher mortality ($P = 0.0001$). The abscess size was larger in the mortality cases than in the survivor cases, however this is not significantly different (8.4 ± 4.1 vs. 6.9 ± 3.9, $P = 0.41$). Univariate analysis revealed that dialysis as an underlying disease, sepsis as an initial manifestation (OR 4.47, CI 9.20–830.54, $P = 0.0001$), serum creatinine level (OR 0.59, CI 0.39–0.89, $P = 0.01$) and C-reactive protein level (OR 0.95, CI 0.91–0.99, $P = 0.01$) were significant

Table 1
Demographic characteristics.

Characteristics	No. of patients (n = 116)	†Period 1 (n = 44)	‡Period 2 (n = 72)	P-value
Age, years	58.5 ± 1.6	56.2 ± 17.4	59.8 ± 18.2	0.29
Sex, male, n (%)	53 (54.3%)	23 (52.3%)	30 (41.7%)	0.27
Comorbid condition				
Diabetes mellitus	34 (29.3%)	9 (20.5%)	25 (34.7%)	0.10
Hypertension	35 (30.2%)	10 (22.7%)	25 (34.7%)	0.17
Chronic liver disease	7 (6.0%)	5 (11.4%)	2 (2.8%)	0.06
Malignancy	16 (13.8%)	4 (9.1%)	12 (16.7%)	0.25
Dialysis	9 (7.8%)	5 (11.4%)	4 (5.6%)	0.26
Previous TB exposure	13 (11.2%)	4 (9.1%)	9 (12.5%)	0.57
Acupuncture history	15 (12.9%)	5 (11.4%)	10 (13.9%)	0.69

†Period 1: years 2001–2006, ‡Period 2 years 2007–2012.

Table 2
Distribution of origin of infection in 105 patients with pyogenic IPA.

	Total (n = 105)	Period 1 (n = 42)	Period 2 (n = 63)
Primary IPA	41 (39.0%)	15 (35.7%)	26 (41.3%)
Secondary IPA	64 (60.9%)	27 (64.3%)	37 (58.3%)
Bone origin	22 (34.4%)	9 (33.3%)	13 (35.1%)
Spondylitis	14	6	8
Septic arthritis	5	2	3
Pelvic osteomyelitis	3	1	2
Intra-abdominal origin	21 (32.8%)	9 (33.3%)	12 (32.4%)
Intestinal perforation	8	4	4
Enteric fistula	4	1	3
Crohn's diseases	2	1	1
Diverticulitis	5	2	3
Necrotizing pancreatitis	2	1	0
Appendicitis	1	0	1
Urinary tract origin	15 (23.4%)	7 (25.9%)	8 (21.6%)
Pyelonephritis	12	6	6
Renal abscess	3	1	2
Skin soft tissue origin	5 (7.8%)	1 (3.7%)	4 (10.8%)
Necrotizing fasciitis	3	1	2
Wound infection	1	0	1
Sore	1	0	1
Vascular origin	1 (1.6%)	1 (3.7%)[a]	0 (0%)

In this table, we analyzed IPA patients excluding the TB cases.
[a] Infected hematoma.

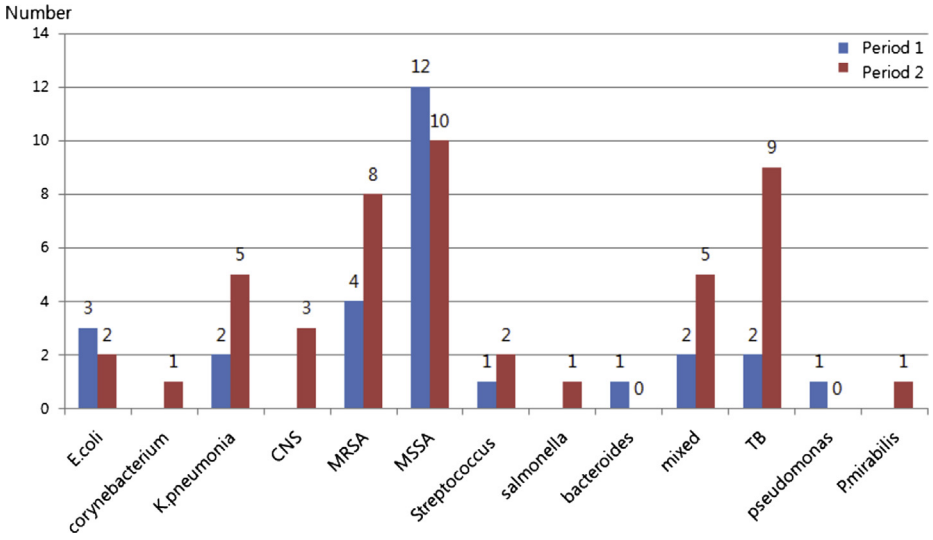

Fig. 1. Microbiological etiology according to the periods among microbiologically confirmed cases. Period 1: years 2001–2006, period 2: years 2007–2012. MRSA; methicillin-resistant *S. aureus*, MSSA; methicillin-sensitive *S. aureus*, TB; tuberculosis.

predictors of mortality. By multivariate analysis, the risk factors for mortality were sepsis as an initial manifestation (OR 293.5, CI 7.1–12,034.4, $P = 0.003$) and serum creatinine level (OR 0.43, CI 0.23–0.80, $P = 0.008$). Treatment included antibiotics alone for 33 (28.4%), antibiotics plus percutaneous drainage for 29 (25%), and antibiotics plus surgery for 54 (46.6%) of the 116 patients. Treatment modality was not associated with the mortality (Table 4), however, subgroup analysis ($n = 64$) for microbiologically confirmed pyogenic IPA cases, excluding *M. tuberculosis*, patients who performed invasive procedures, including percutaneous drainage or surgery, showed significantly favorable outcomes as compared to those who received only antibiotics (46/50 [92%] vs. 9/14 [64.3%], $P = 0.008$). Abscess size and the presence of bacteremia were not associated with the mortality in multivariate analysis (Table 4).

5. Discussion

IPA is a rare disease and thus far, only IPA reports of small case series have been published.[6–8] This current study demonstrates the etiology, treatment and clinical outcome of 116 patients with IPA in Korea, and this constitutes a relatively large case series. In the pre-antibiotic era, TB was known to be one of the most common complications in patients with IPA, especially in cases of Pott's disease. There is an increasing trend of pyogenic psoas abscess, while the incidence of TB is decreasing worldwide.[9–11] One study, including 24 patients with IPA from 1996 to 2001 in Korea showed that *S. aureus* ($n = 7$) was the most frequent pathogen, followed by *M. tuberculosis* ($n = 6$), and more methicillin-sensitive *S. aureus* strains (77.8%, 7/9) were identified than MRSA (28.5%, 2/7).[12] In our present study, since 2001, *S. aureus* was the most important pathogen of IPA, and the percentage of MRSA was slightly increased at 35.3% compared with the previous data.[12] According to the periods, the percentage of MRSA in 2007–2012 increased remarkably compared to 2001–2006, from 25% to 44.4%, although this increase was not statistically significant. There was one report on the increase in MRSA as the leading cause of IPA, and this change may be due to several reasons including increasing immunocompromised hosts, drug resistant organisms and repeat surgery.[13]

Our study also showed that a large percentage of IPA consisted of *M. tuberculosis* in Korea until recently. The percentage of TB among microbiologically confirmed cases in 2007–2012 increased compared to 2001–2006, although this increase was not statistically significant. Korea is still intermediate TB risk area, where new

Table 3
Comparison of characteristics between surviving and deceased patients.

Characteristics	Survival ($n = 103$)	Mortality ($n = 13$)	*P*-value
Age, years	57.7 ± 18.3	64.4 ± 13.7	0.2
Sex, male	47 (45.6%)	6 (46.2%)	0.97
Diabetes mellitus	31 (30.1%)	3 (23.1%)	0.60
Malignancy	13 (12.6%)	3 (23.1%)	0.30
Dialysis	5 (4.9%)	4 (30.8%)	0.001
S. aureus as an etiology	29 (28.2%)	5 (38.5%)	0.44
Microbial confirmed	66 (64.1%)	9 (69.2%)	0.71
Hospital day to diagnosis, days	3.9 ± 8.4	2.5 ± 3.7	0.57
White blood cell, mm^3	14,002 ± 6906	13.796 ± 7185	0.92
Platelet, mm^3	21,078 ± 69,800	9328 ± 32,378	0.56
Creatinine, mg/dl	1.1 ± 0.8	2.8 ± 3.4	0.01
ESR, mm/h	66.7 ± 31.9	61.3 ± 39.7	0.60
C-reactive protein, mg/dl	13.2 ± 10.1	25.0 ± 24.2	0.01
Presence of bacteremia	35 (34.7%)	7 (53.8%)	0.30
Sepsis as an initial manifestation	1 (1.0%)	6 (46.2%)	0.0001
Invasive procedure[a]	76 (73.8%)	7 (53.8%)	0.13
Abscess size, cm	6.9 ± 3.9	8.4 ± 4.1	0.41

[a] Invasive procedure includes percutaneous drainage and surgery.

Table 4
Risk factors for mortality.

	Univariate analysis			Multivariate analysis		
	OR	95% CI	*P*-value	OR	95% CI	*P*-value
Age	0.97	0.94–1.0	0.20			
Diabetes mellitus	1.44	0.37–5.57	0.60			
Dialysis	8.71	1.98–38.32	0.004	7.95	0.18–339.03	0.28
Sepsis as an initial manifestation	4.47	9.20–830.54	0.0001	293.5	7.1–12,034.4	0.003
Invasive procedure	0.59	0.18–1.98	0.39			
White blood cell count	0.99	0.99–1.01	0.92			
Platelet	1.01	0.98–1.02	0.56			
Creatinine	0.59	0.39–0.89	0.01	0.43	0.23–0.80	0.008
C-reactive protein	0.95	0.91–0.99	0.01	0.95	0.89–1.00	0.06
Presence of bacteremia	2.2	0.69–7.05	0.18			
Abscess size	0.92	0.74–1.13	0.41			

TB cases develop from 50 to 149 per 100,000 populations in 2011, although the downward trend of incidence continues.[14] In addition, it is interesting that disseminated TB cases, which spread hematogenously from lung, were found to be as high as 45.4% (5/11). In studies from Spain and Turkey, most tuberculous cases were considered secondary IPA.[15,16] The high prevalence of TB in the etiology of IPA, especially disseminated TB cases, reflects this public health problem, and serves to highlight the importance of TB control to help reduce transmission in Korea. Our study indicated that IPA due to *M. tuberculosis* was more common in patients with previous TB exposure and we should consider TB as a cause of IPA in patients with previous TB exposure in TB intermediate-risk areas such as Korea. It is well known that latent TB can develop active disease in 10% of persons in a lifetime.[17]

The advances in intervention and effective antimicrobial therapy have improved survival of patients with IPA, and several recent studies report an IPA mortality of approximately 5%.[15,18] It is difficult to analyze the risk factors for mortality in IPA patients because of the rarity of IPA. There are few studies about risk factors, but some have reported that bacteremia, older age and comorbidity were associated with mortality in patients with IPA.[15,18] In our study, in-hospital mortality was as high as 11.2%, and the risk factors associated with mortality in IPA patients were sepsis as an initial manifestation and high serum creatinine levels. Therefore the clinical status at the time of admission affects the outcome in patients with IPA.

It is well known that source control is of importance in cases of intra-abdominal infection.[19] Surgical drainage and intestinal resection are beneficial if the origin of IPA is Crohn's disease, and percutaneous drainage is considered to be a good option with a success rate of 90% after it was first described in 1984.[20–22] There was a report that patients with small abscesses responded well to antibiotics alone, and in our study, patients with a small size of IPA or who performed invasive procedure showed favorable outcome.[23] Therefore, we should consider invasive drainage especially for patients with for large sized pyogenic IPA.

Our study has some limitations. First, this is a retrospective study including 116 cases of IPA. However, IPA has been described globally as a rare disease, and this study includes relatively large cases series culled over 10 years in Korea. Second, this study does not evaluate the appropriate antimicrobial effect on outcome, and further studies will be needed. Third, it is difficult to differentiate between primary and secondary IPA, and so we arbitrate the opinion by two infectious disease specialists.

In conclusion, *S. aureus* from skeletal source is still the most prevalent microorganism of IPA and MRSA shows an increased tendency to occur in IPA patients in Korea. Although the overall prevalence of TB is decreasing, TB is still considered to be an important cause of IPA. Initial clinical status and invasive intervention can lead to favorable outcomes.

Ethical approval

This study was approved by the institutional review board of the Catholic University of Korea (XC12RIME0146).

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None.

Author contribution

Youn Jeong Kim, Jai HoonYoon: concept, data analysis.
Youn Jeong Kim: writing.
Yang Ree Kim : critical revision.
Sang Il Kim : data collection.
Seong Heon Wie : data collection.

Conflict of interest

None to declare for all of the coauthors.

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