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Research Article

An Appraisal of Clinical and Hematological Parameters Linked to Recurrence in Surgically Drained Primary Psoas Abscesses: A Retrospective Comparative Study

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Abstract

Aim: Psoas abscess is rare infectious condition with frequent complications in the diagnosis and treatment process. Unfortunately, there is limited information in the literature about the prognostic factors that determine the prognosis of psoas abscess. Therefore, the aim of this study was to evaluate the clinical and laboratory parameters associated with recurrence in primary psoas abscess.

Material and Methods: Fifty-two patients who were diagnosed with psoas abscess and treated with surgical drainage in a university hospital between 1998 and 2018 were included in our study. The patients were seperated into two groups as those who recovered after surgical drainage (Group A) and those who developed recurrence (Group B). Clinical and laboratory data of the patients from the beginning of the preoperative period to the postoperative period were compared.

Results: The mean age was 47.42±14.12 years in Group A and 53.81±15.83 years in Group B. The mean follow-up time was 43.96±14.29 months. The neutrophil to lymphocyte ratio was 11.38±1.69 in Group A and 18.75±2.31 in Group B (p=0.001). The platelet to lymphocyte ratio was 114.96±30.31 in Group A and 139.70±42.25 in Group B (p=0.016). The Acute Physiology and Chronic Health Evaluation (APACHE II) score was higher in Group B (p=0.001).

Conclusion: According to the results of the current study, the neutrophil to lymphocyte ratio, the platelet to lymphocyte ratio, the APACHE II score, and the delayed diagnosis are all important prognostic indicators linked to recurrence in instances with primary psoas abscess.

Keywords: Primary psoas abscess, recurrence, surgical drainage, neutrophil to lymphocyte ratio, platelet to lymphocyte ratio, APACHE II score

INTRODUCTION

Psoas abscess (PA) is a potentially very dangerous infective process that results from the accumulation of pus throughout the iliopsoas muscle due to various condition. The iliopsoas muscle is the strongest of the hip flexors and is primarily responsible for hip flexion. It originates from the twelfth thoracic vertebra and extends distally, and attaches on the lesser trochanter after traveling within the pelvic ring and passing the hip joint anteriorly. Although the worldwide prevalence is unknown, it is known that it is extremely low, with up to 12 instances recorded annually in centers that address this issue (1-3). Psoas abscesses are etiologically classified as primary and secondary. The pathogenesis of primary psoas (pPA) abscesses is still unclear. The mechanism generally considered is that the infection spreads from a distant part of the body by lymphatic or hematogenous route (4,5). The etiology of pPAs typically include intravenous drug abuse, diabetes, acquired immunodeficiency syndrome (AIDS), alcoholism, malnutrition, or malignancy. They are more common under the age of 20 and in men at a ratio of 3:1.3-5 (4,6). Secondary psoas abscess (sPA) occurs through direct spread from the focus of infection

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in organs adjacent to the psoas muscle, such as kidney, bladder, ureter, sigmoid colon, jejunum, and vertebral column (2,7). While pPA is more common in younger ages with a prevalence ranging from 30% to 61%, the prevalence of sPA is 70% and the most common cause is reported to be Chron's disease (5). The followings should be considered in the differential diagnosis of PA: vascular patologies, pyelonephritis, appendicitis, urolithiasis, vertebral osteomyelitis, avascular necrosis of the femoral head, aortic or iliac artery aneurysm, gastrointestinal tract pathologies, Chron's disease, and malignancies. For the differential diagnosis of PA, the medical history of the patient should be taken carefully and physical, laboratory, and radiological examinations should also be performed carefully (8).

There is limited information in the literature regarding prognostic factors that determine the prognosis of PA. Delayed diagnosis, comorbidities, positive blood culture, elevated serum C-reactive protein (CRP) and creatinine levels, and advanced age are the known poor prognostic factors for PA (9-11). The goal of treatment is to drain the purulent fluid collected in the psoas compartment through surgical or percutaneous drainage and to use appropriate antibiotic therapy (4,12).

The factors of recurrence of psoas abscess has not been revealed in the previous published reports. Our aim in this study was to evaluate and compare the prognostic factors in the diagnosis and treatment process of pPA, which are rare and may have catastrophic consequences, and to provide the literature with a broader perspective.

MATERIAL AND METHOD

Study Design and Participants

We undertook a single-center, retrospective study. The data of the patients during the diagnosis and treatment process were retrospectively analyzed from archive records. The study group consisted of patients, who were admitted to the emergency department or orthopaedic outpatient clinic of a university hospital center between December 1998 and January 2018, and treated by surgical drainage due to PA diagnosis.

Patients were divided into two groups: Group A consisting of patients who were recovered after surgical drainage and Group B consisting of patients requiring repeated surgery due to recurrence. The data of 52 patients who were followed for at least 24 months were analyzed retrospectively.

The study was conducted in accordance with the Declaration of Helsinki. This research did not receive support from any national or international institution or organization.

Methods of Measurement

Clinical conditions and laboratory data, length stay in hospital, time until diagnosis, abscess morphology, intraoperative pus drained, drain removal time (days), blood culture, pus culture, smoking habit, intravenous drug abuse, comorbidities, and microbiological data of the patients were analyzed and compared to determine the factors associated with recurrence. The comorbidities of the patients were evaluated according to the age-adjusted Charlson comorbidity index. The Charlson Comorbidity Index predicts patients' survival with several comorbidities. It is comprised of 17 items linked to a variety of health issues connected with mortality (13). The Charlson index can predict both short-term and long-term outcomes, such as function, hospitalization duration, and death rates (Table 1). When calculating the age adjusted charlson comorbidity index, 1 more point is added for each decad after the age of 40. The Acute Physiology and Chronic Health Evaluation (APACHE II) scoring system, which incorporates many clinical and laboratory parameters, was used to evaluate the severity of the disease and its relationship with recurrence (14). Physiological variables evaluated in APACHE II include body temperature, mean arterial pressure, heart rate, respiratory rate, oxygenation, arterial PH, venous HCO3-, sodium, potassium, serum creatine, hematocrit, leukocytes, and Glasgow Coma Score. Computed tomography (CT) and magnetic resonance imaging (MRI) were used for radiological diagnosis in all patients. In the post-treatment period, MRI and ultrasonography (USG) were used for follow-up. Presence of an infectious process in the adjacent organs was also evaluated with imaging methods.

Table 1. Charlson comotbidity index items

Comorbidity	Score
Myocardial infarction	1
Congestive heart failure	1
Peripheral vascular disease	1
Cerebrovascular disease	1
Dementia	1
Chronic pulmonary disease	1
Rheumatologic disease	1
Peptic ulcer disease	1
Liver disease	1 if mild, 3 if moderate/severe
Diabetes	1 if controlled, 2 if uncontrolled
Hemiplegia or paraplegia	2
Renal disease	2
Malignancy	2 if localized, 6 if metastatic tumor
Leukemia	2
Lymphoma	2
AIDS	6

All patients were operated under general anesthesia. The performed surgical method was retroperitoneal surgical drainage with a mini-incision, debridement, and washing with saline solution. Regardless of the amount of pus that came intraoperatively and the character of the abscess, all patients were washed with 10,000 cc of saline.

Postoperative Follow-up

Postoperative surgical material culture was tested for

bacteria, fungi, and tuberculosis and antibiotic therapy specific to the growing microorganism was administered IV. Hemovac drain was removed when drainage was below 10 ccs and this was maintained for at least 12 hours, patients' erythrocyte sedimentation rate (ESR), white blood cell (WBC), and C reactive protein (CRP) values decreased, and there was no visualizable pus on USG. Patients were discharged if no exacerbations were observed during the postoperative period; WBC, CRP, and ESR values returned to normal; and healing was confirmed by USG. In the postoperative period; clinical, radiological, and laboratory parameters of the patients were evaluated at one-month intervals for the first three months and at three-month intervals thereafter. After 24 months, patients were called for control on an annual basis.

Statistical Analysis

Analyses for the demographic characteristics of the data obtained from the study were carried out using descriptive statistical analysis methods (frequency and percentage analysis, mean and standard deviation values). While categorical variables were tested with chi-square, t-test was used to test numerical variables. The data that were significant in the univariate analysis (P value < 0.05) were detected. Multivariate logistic regression analysis was applied to identify independent predictors that were associated with recurrence. Statistical analysis was performed with SPSS for Windows version 25.0 and a P value < 0.05 was accepted as statistically significant.

RESULTS

Characteristics of Study Subjects

This retrospective single center comparative study analyzed a total of 65 patients who were treated by surgical drainage due to the diagnosis of pPA in our clinic. Four patients died during the follow-up, due to sepsis. Although nine patients recovered after surgical drainage, they were excluded from the study due to insufficient data. The mortality rate was 6.1% (n=4), and the recurrence rate was 24.6% (n=16) in pPA cases presenting to our clinic. The mean age of the patients was 47.42±14.12 years in Group A and 53.81±15.83 years in Group B. While the ratio of males to females was 2:1 in Group A, it was 1.6:1 in Group B. One patient in Group B had bilateral PA. The mean follow-up time was 43.96±14.29 months and the mean length of surgery was 43.29±10.28 minutes. Before receiving the diagnosis, 44 (84.6%) patients had applied to the emergency department or orthopedic outpatient clinic at least once and 35 (67.3%) of these patients had applied to the hospital more than once. The most common accompaying comorbidities were diabetes mellitus (28.8%), followed by hypertension (25%) and coronary artery disease (17.3%), respectively. The most common clinical symptom in both groups was fever. The triad of fever, flank pain, and hip movement limitation were present in 36% of the patients in Group A and 50% of the patients in Group B (Table 2).

Table 2. Descriptive and demographic variables of patients

		Group A (n=36)		Group B (n=16)		P value
Age (years), mean ±SD		47.42±14.12		53.81±15.83		0.153
Sex	Male	24 (66.7%)		Male	10 (62.5%)	0.771
	Female	12 (%33.3)		Female	6 (37.5%)	
Length stay in hospital (day), mean±SD		24.36±4.33		25.31±4.44		0.471
Time to recurrence (month), mean ±SD		-		5.19±1.76		-
Age-adjusted Charlsoncomorbidity index		2.02±1.47		2.09±1.69		0.426
Clinical presentation (Since there is more than one symptom in the same patient, the total number may exceed the number of patients)	Fever	18 (50%)		Fever	10 (62.5%)	-
	Flank pain	16 (44.4%)		Flank pain	8 (50%)	
	Restricted hip mobility	13 (36.1%)		Restricted hip mobility	8 (50%)	
	Anorexia	12 (33.3%)		Weight loss	9 (56.2%)	
	Nausea and vomiting	10 (27.8%)		Anorexia	9 (56.2%)	
	Weight loss	10 (27.8%)		Nausea and vomiting	6 (37.5%)	
	Thigh pain	9 (25%)		Thigh pain	6 (37.5%)	
	Flank mass	6 (16.6%)		Flank mass	4 (25%)	
	Abdominal pain	6 (16.6%)		Abdominal pain	4 (25%)	
	Local redness	4 (11.1%)		Local redness	3 (18.7%)	

SD; Standart deviation

Abdominal and thoracic CT was combined with MRI in all patients. Diagnosis was established using CT alone in 49 (94.2%) patients. In three (5.7%) patients, the diagnosis was confirmed by MRI and a diffuse sPA was ruled out. Thanks to the radiological examinations, exclusion was achieved for sPA.

Main Results

Preoperatively measured hematological parameters were analyzed and compared between the groups (Table 3). The neutrophil to lymphocyte ratio (NLR) was 11.38±1.69 in Group A and 18.75±2.31 in Group B (p=0.001). The platelet to lymphocyte ratio (PLR) was 114.96±30.31 in Group A and 139.70±42.25 in Group B (p=0.006). The amount of intraoperatively drained pus was 140.28±58.63 cc in Group A and 170.63±52.97 cc in Group B (Table 4). Patients in Group B were observed to have higher APACHE II scores (p=0.001).

Multiple logistic regression identified the following risk factors for recurrence in pPA: time until diagnosis (odds ratio (OR):1.038; 95% confidence interval (95% CI):1.008–1.070) (p value:0.013), NLR (OR: 1.077; 95% CI:1.034–1.122; p<0.001), PLR (OR:1.043;95% CI:1.012–1.083; p=0.016) and APACHE 2 score (OR:1.168; 95% CI:1.108-1.230; p<0.001). BMI was insignificant in multiple logistic regression analysis (OR:1.069; 95% CI:0.808–1.416; p= 0.639).

Although 32 (61.5%) patients had blood culture positivity, there was no significant relationship between the groups (p=0.924). Forty-three bacterial pathogens were isolated from 38 patients with bacterial growth. Polymicrobial flora was present in one patient in Group A and two patients in Group B. Staphylococcus Aureus was the most common microorganism isolated from the culture of surgical material in both groups (n=32, 61.5%), (Table 5). In the present study, microbiological pathogens were

Table 3. Hematological parameters associated with recurrence

Variables	Group A (n=36)	Group B (n=16)	P value
Preoperative albumin level (g/L), mean±SD	2.42±0.67	2.31±0.81	0.347
Preoperative platelet to lymphocyte ratio	114.96±30.31	139.70±42.25	**0.001**
Preoperative neutrophil to lymphocyte ratio	11.38±1.69	18.75±2.31	**0.001**
Preoperative red blood cell distribution width (%), mean±SD	16.69±2.04	16.88±2.47	0.773

SD; Standart deviation

Table 4. Clinical and microbiological features associated with recurrence

Variables	Group A (n=36)		Group B (n=16)		P value
Intraoperative pus drained (cc), mean±SD	140.28±58.63		170.63±52.97		0.082
Abscess morphology	Multiloculated	24 (66.7%)	Multiloculated	10 (62.5%)	0.771
	Monoloculated	12 (33.3%)	Monoloculated	6 (37.5%)	
Drain removal (days), mean±SD	7.82±0.84		7.88±0.92		0.588
Time until diagnosis (weeks), mean±SD	8.36±2.42		19.31±4.17		**0.001**
Side	Left	21 (58.3%)	Left	6 (37.5%)	0.076
	Right	15 (41.7%)	Right	10 (62.5%)	
Body mass index (kg/m²), mean±SD	26.5±2.98		21.21±3.01		0.007
APACHE II score, mean±SD	11.22±1.99		14.19±2.86		**0.001**
Age-adjusted Charlson comorbidity index	2.02±1.47		2.09±1.69		0.426
Blood culture	Positive	22 (61.1%)	Positive	10 (62.5%)	0.924
	Negative	14 (38.9%)	Negative	6 (37.5%)	
Pus culture	Positive	26 (72.2%)	Positive	12 (75.0%)	0.835
	Negative	10 (27.8%)	Negative	4 (25.0%)	
Smoking habit	Smoker	21 (58.3%)	Smoker	13 (81.2%)	0.109
	Nonsmoker	15 (41.7%)	Nonsmoker	3 (18.8%)	
Intravenous drug abuse	User	10 (27.7%)	User	6 (37.5%)	0.573
	Nonuser	26 (72.3%)	Nonuser	10 (62.5%)	

detected in pus culture in 38 (73%) patients. There was bacterial growth in the blood culture of two patients who did not have any growth in the pus culture. Exact pathogen was determined in 40 (76.9%) patients using the combination of blood and pus culture. Methicillin-resistant Staphylococcus aureus (MRSA) was observed in two patients in both groups. In Group B, growth of Candida albicans was observed in a 62-year-old male patient with diabetes mellitus and chronic kidney disease. Average duration of IV antibiotherapy in hospital was 24.36±4.33 days in Group A and 25.31±4.44 days in Group B (p=0.471). The mean recurrence time after discharge was 5.19±1.76 months. In the postoperative period; clinical, radiological, and laboratory parameters of the patients were evaluated at one-month intervals for the first three months and at three-month intervals thereafter. After 24 months, patients were called for control on an annual basis.

Table 5. Microbiological analysis of pus culture

Microorganisms (n=43)	Group A (n=28)	Group B (n=15)
Staphylococcus aureus	21	11
Escherichia coli	2	1
Streptococcus viridans	2	1
Group B Streptococcus	1	1
Bacteroides	1	0
Acinetobacter baumannii	1	0
Candida albicans	0	1
Culture-negative	10	4

n= Total number of microorganisms from pus culture

DISCUSSION

According to the literature review and our knowledge, this is the largest series in the literature evaluating pPAs. Yacoub et al. reported seven cases per year in a regional study conducted in the United States. The annual incidence in our clinic was eight cases per year (15). In the literature, the mortality rate is known to be 2.3% in pPAs while it can reach 18.9% in sPAs (16,17). Recurrence rate is reported to range from 14% to 37.5% (10,17,18). In the present study, the mortality and recurrence rates were 6.1% and 24.6%, respectively.

The pPAs are more common in patients younger than 20 years of age (2,20). Recent studies have reported that the prevalence of pPA has increased to 38.3% in advanced age (21,22). In contrast to the old literature, age distribution concentrated on the fourth to the fifth decades of life in Group A whereas the fifth and sixth decades of life in Group B in the present study, compatible with the current literature. In this study, age was not a predictive factor for recurrence. Lai et al. reported the ratio of males to females as 1.62:1 (23). Compatible with the literature, the number of male patients was higher in our study. The rate of intravenous drug abuse is reported to be up to 86% in pPA cases (24).

The rates of intravenous drug abuse and smoking in the present study were 30.7% and 65.3%, respectively and neither of them were found to be associated with recurrence. Additional pathology may be present in 50% of patients with PA, regardless of being primary or secondary (25).

Diabetes mellitus was the most common comorbid condition (28.8%) in the present study. The time from the onset of symptoms to diagnosis ranged from 11 to 120 days (10,26). The time until diagnosis was significantly shorter in Group A than in Group B. The present study shows that the longer the diagnosis time, the higher the likelihood of recurrence.

The literature review has shown that there is no relationship between the volume of abscess drained and prognosis (11). Although the volume of abscess drained in Group B was larger in the present study, it was not statistically significant. There are studies reporting that the drainage time ranged from 2.4 to 45 days in psoas abscesses (18,27). No association was detected in our study between prolonged drainage time and recurrence. We recommend that if the amount of drainage is below 10 ccs for the last 24 hours after sufficient surgical drainage, the drain should be removed following a USG control, and thus, complications that may result from prolonged drain time can be avoided.

In a study by Baier et al., while APACHE II score was found to be associated with mortality, there was no relationship between recurrence and APACHE II score (9). In contrast to their study, the APACHE II score was found to be associated with recurrence in the present study. Thus, we believe that it can be used as a predictive factor for pPA. The reason why this score is significant in our study may be, we only included patients who underwent surgical drainage in our study. Different factors may be associated with recurrence in patients receiving conservative treatment or undergoing percutaneous drainage. Lopez et al. reported weight loss in 37.1% of patients with PA (10). In the present study, the body mass index (BMI) was found to be lower in Group B than Group A but this is not significant. This may be explained by the fact that patients potentially experience loss of appetite and the time to diagnosis in those who developed recurrence is longer.

Elevated NLR levels have been used as a guide in the prognosis of various diseases in many previous studies, such as pneumonia, sepsis, and cancer; however, its relationship with prognosis in PAs has not been investigated in any studies (28). Elevated PLR is an easily accessible, effective, and novel inflammatory marker used in many diseases to determine the severity of inflammation and mortality (29). The present findings suggest that NLR and PLR are safe and easily applicable markers to predict the likelihood of recurrence in pPAs. Besides the studies reporting that high red cell distribution width (RDW) predicts increased mortality in infective processes, such as sepsis and septic shock, there are also studies indicating that it does not have any predictive

feature (30,31). Although the increased level of RDW was observed to be within normal limits in both groups in the present study, it was found to have no predictive value for recurrence in PAs.

Positive blood culture is reported to be associated with increased mortality in some studies whereas there are studies reporting no relationship between the presence of positive blood culture and increased mortality (10,11). We found that high bacterial growth rate in blood or pus culture was not a prognostic marker in pPAs. In the present study, MRSA growth was observed in the pus cultures of four (7.6%) patients. The incidence of MRSA in PAs is variable, and it is difficult to estimate the accurate incidence rates (10). Patients with MRSA should be isolated and given an appropriate treatment based on the antibiogram results

Limitations

Our study had several limitations. Firstly, we conducted our study retrospectively. Although we made a good clinical evaluation and used effective imaging methods, we had to classify patients whose foci of infection were unidentified as primary bacteremia. We only included patients who underwent surgical drainage in our study. Different factors may be associated with unsatisfactory clinical outcomes in patients receiving conservative treatment or undergoing percutaneous drainage. There is a need for randomized controlled trials involving larger patient populations. The present study has notable strengths. This study provided novel findings relevant to the recurrence in pPA. The other strength of this study is that it is more innovative and has a larger sample size than all previous studies.

CONCLUSION

The present study has analyzed and updated easy-to asses, safe, and valid hematological and clinical parameters used for the prediction of recurrence in pPAs. The following conclusions can be drawn from this study: Elevated NLR and PLR levels are prognostic hematological parameters for recurrence in pPA cases. APACHE II score, delayed diagnosis can be used as clinical markers associated with recurrence. In conclusion, predicting the development of recurrence in this rare disease, whose diagnosis and treatment process is challenging, will ensure that treatment and follow-up plans are made according to the possibility of recurrence.

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Ethical approval: *The study protocol was approved by the Scientific Research Ethics Committee of Gaziantep University, (Noninterventional Clinical Studies Institutional Review Board 24.06.2020, 2020/211).*

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