

Original Research

Clinical Characteristics of Pyometra: Eleven Years of Experience from a Single Institution

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Academic Editor: Felix Wong

Submitted: 8 April 2023 Revised: 26 April 2023 Accepted: 5 May 2023 Published: 19 June 2023

Abstract

Background: Pyometra is defined as an accumulation of purulent material in the uterine cavity. It is caused by natural drainage impairment within the cervix and occurs predominantly in elderly women. In this study, we aimed to investigate the clinical characteristics and recurrent risk of pyometra. **Methods:** Data for patients diagnosed with pyometra between 2010 and 2021 were retrospectively reviewed. Basic patient characteristics, including age, underlying disease, management, chief complaint, antibiotics, and isolated organisms, were investigated. The risk of recurrence of pyometra was assessed using multivariate logistic regression analyses. In total, 65 patients with pyometra were included in this study. **Results:** The mean age of the patients was 75.8 ± 16.4 years. About half of the patients had been admitted to a nursing hospital due to poor mobility, and 61.5% of the patients had an Eastern Cooperative Oncology Group performance score of 2 or higher. The most prevalent presenting symptoms were vaginal discharge (73.9%) and fever (16.9%). Forty-eight (75.0%) patients underwent drainage, and seven (10.9%) underwent hysterectomy. *Escherichia coli* accounted for the most cases (36.9%), followed by *Klebsiella pneumoniae* (20.0%). Overall, 17 patients were extended-spectrum β -lactamase positive. Recurrence after drainage occurred in 16 (24.6%) of the 65 patients, and two patients died from septic shock. The isolation of *Klebsiella pneumoniae* was identified as a significant risk factor for recurrence (odds ratio (OR): 4.71; 95% confidence interval (CI): 1.09–20.47; $p < 0.05$). **Conclusions:** Because pyometra often occurs in elderly patients with chronic diseases, it is important to pursue appropriate treatment and prevention of recurrence to decrease the morbidity and mortality associated with this condition. The isolated organisms should be considered as a predisposing factor for recurrent pyometra.

Keywords: pyometra; uterine infection; *Klebsiella pneumoniae*; recurrence

1. Introduction

Pyometra is defined as the formation of an abscess in the uterus. It is caused by disturbances in natural excretion from the uterus. Pyometra occurs in about 0.2% of all females and up to 13.6% of elderly patients [1]. Risk factors for pyometra include benign tumors, presence of an intrauterine device, radiation cervicitis, atrophic cervicitis, postoperative cervical occlusion, and malignant tumors [2,3]. However, pyometra can occur in late stages of pelvic inflammatory disease, so it can also occur in premenopausal women without being associated with a benign or malignant tumor [4]. The accumulation of purulent contents in the endometrial cavity can lead to systemic inflammation [5]. Both an endometrial infection and a blockage or stenosis of the cervix must be present for pyometra to form, as these conditions prevent the natural drainage of the uterine cavity. The first symptoms of pyometra patients reported by physicians are vaginal discharge, abdominal pain, and fever [6]. However, most patients are initially asymptomatic. As the

disease gradually worsens, patients generally show fever and/or abdominal pain and visit the emergency room [7].

Patients with immunocompromising chronic diseases—including renal failure, diabetes mellitus, and steroid users—are particularly vulnerable to uterine abscess [8]. Although accurate diagnosis, early intervention, and proper management can lower the morbidity of pyometra, it can be a life-threatening disease in certain cases [9]. If fluid collection inside the uterus without perforation is observed via transvaginal ultrasound, it can be managed by draining the uterine cavity through the cervical canal. Histological examination of the endometrium or cervix should be performed in such cases to rule out the possibility of gynecologic malignancy. It is important to note that there is an increased risk of recurrence in immunocompromised patients [10]. When recurrence occurs, the risk of uterine perforation increases because inflammation of the uterine wall can become more severe, and uterine perforation can cause sepsis or death.



Three representative symptoms of pyometra are purulent vaginal discharge, lower abdominal pain, and postmenopausal vaginal bleeding. About half of patients with pyometra are asymptomatic and incidentally diagnosed [11]. Because of its non-specific symptoms, such as vaginal discharge or abdominal pain, an accurate diagnosis is often delayed, which can worsen the patient's condition. Moreover, most patients with pyometra are elderly people with comorbidities [12]. There is a need for more studies examining the clinical characteristics of pyometra because it is often neglected for a long period of time or treated only as an emergency disease at the time of uterine rupture [13]. Therefore, the aim of the present study was to investigate the clinical characteristics of pyometra cases seen in a single institution and analyze risk factors for its recurrence.

2. Materials and Methods

2.1 Patients

This was a retrospective case control study of patients who were hospitalized for treatment after the diagnosis of pyometra. Data were collected from Kangwon National University Hospital for patients admitted from 2010 to 2021. We enrolled patients who were admitted with pyometra, had an intrauterine abscess measuring 3 cm or more on transvaginal ultrasound, and underwent drainage. Patients with suspected pyometra but not confirmed by drainage were excluded. Furthermore, patients with small intrauterine fluid collections with a maximum diameter of less than 3 cm were excluded.

2.2 Clinicopathologic Characteristics

We extracted each patient's hospital admission records, gynecological ward follow-up charts, laboratory and imaging scan reports, operation reports, and results of microbial culture from the electronic medical record databases of our medical center.

The following data points were extracted: age; admission to nursing facilities; medical history (hypertension, diabetes mellitus, brain hemorrhage, dementia); Eastern Cooperative Oncology Group (ECOG) performance score; type of surgical management (aspiration, Foley insertion, hysterectomy); symptoms (vaginal discharge, fever, abdominal pain); white blood cell (WBC) count; C-reactive protein (CRP); and serum albumin. Patients were treated with antibiotics using the following regimens: cephalosporin, metronidazole, cephalosporin/metronidazole, and others. The identified intrauterine pathogens were *Escherichia coli* (*E. coli*), *Klebsiella pneumoniae* (*K. pneumoniae*), and others. Extended spectrum beta lactamase (ESBL) was also assessed. Carcinoma in the endometrium or cervix was pathologically confirmed.

2.3 Statistical Analysis

Significance between groups was assessed using the chi-squared test and Fisher's exact test for categorical variables. Logistic regression was used to evaluate the risk factors for recurrence. A p -value < 0.05 was considered to indicate statistical significance.

3. Results

In total, 65 patients were included in this study. There was no recurrence in 49 patients whereas pyometra recurred in 16 patients. Table 1 lists the patient characteristics. About half of the patients had been admitted to nursing facilities (50.8%, 31/65). Although recurrence was more frequent in patients in nursing facilities than it was in patients not in nursing facilities (64.3% versus 46.8%, $p = 0.25$), that difference was not statistically significant. Among the comorbidities, hypertension was the most common (32 patients, 49.2%), followed in order by diabetes (16 patients, 24.6%), cerebral hemorrhage (nine patients, 13.9%), and dementia (nine patients, 13.9%). There was no significant difference in underlying disease between the relapsed group and the non-relapsed group.

More pyometra patients were found to have ECOG 2–4 than ECOG 0–1, indicating that many patients were limited in their physical activity. The ECOG performance scale score did not differ significantly between the relapsed and non-relapsed groups. Endometrial aspiration using a *Pipelle* or the like was performed most frequently (in 73.8% of patients), followed in order by hysterectomy (7.7%) and Foley insertion (4.6%). The main symptoms of the subjects when they visited the hospital were vaginal discharge (73.9%), fever above 38 °C (16.9%), and lower abdominal pain (13.9%).

On average, WBC counts were elevated to $11.78 \times 10^3/\text{mm}^3 \pm 7.22 \times 10^3/\text{mm}^3$. CRP was also elevated to 6.34 ± 9.53 mg/L. The WBC counts and CRP levels were higher in patients with recurrent pyometra than in those without recurrence, although these differences were not statistically significant (WBC: $14.22 \pm 8.79 \times 10^3/\text{mm}^3$ versus $10.85 \pm 6.43 \times 10^3/\text{mm}^3$, $p = 0.1541$; CRP: 8.37 ± 13.79 mg/L versus 5.43 ± 7.04 mg/L, $p = 0.3810$). Albumin levels were lower in patients with recurrent pyometra (recurrence: 3.45 ± 0.69 g/dL, no recurrence: 3.85 ± 0.63 g/dL, $p = 0.0718$), but this difference was not statistically significant either. Cephalosporin was the most frequently administered antibiotic (41.5%), followed in order by cephalosporin/metronidazole (24.6%) and metronidazole (6.2%).

A multiple regression analysis was used to evaluate the risk of pyometra recurrence; the results are shown in Table 2. Age, admission to nursing facilities, comorbidity (hypertension, diabetes, dementia), ECOG performance score, fever, microbial culture, and ESBL were included as variables in the analysis. In the microorganism culture test for intrauterine abscess, the group with *Klebsiella pneumoniae*

Table 1. Basal characteristics of patients with pyometra.

Variables	All patients (n = 65)	No recurrence (n = 49)	Recurrence (n = 16)	p-value
Age, years	75.82 ± 16.37	74.67 ± 17.66	79.31 ± 11.34	0.3290
Nursing facility	31 (50.8)	22 (46.8)	9 (64.3)	0.2509
Comorbidity				
Hypertension	32 (49.2)	23 (46.9)	9 (56.3)	0.5177
Diabetes	16 (24.6)	13 (26.5)	3 (18.8)	0.5305
Brain hemorrhage	9 (13.9)	9 (18.4)	0 (0.0)	0.0648
Dementia	9 (13.9)	5 (10.2)	4 (25.0)	0.1368
ECOG performance status score				0.4947
0–1	25 (38.5)	20 (40.8)	5 (31.3)	
2–4	40 (61.5)	29 (59.2)	11 (68.7)	
Surgical management				0.7882
None	9 (13.8)	8 (16.3)	1 (6.7)	
Aspiration	48 (73.8)	34 (69.4)	14 (87.5)	
Foley insert	3 (4.6)	2 (4.1)	1 (6.7)	
Hysterectomy	5 (7.7)	5 (10.2)	0 (0.0)	
Symptom				
Vaginal discharge	48 (73.9)	36 (73.5)	12 (75.0)	0.9037
Fever >38 °C	11 (16.9)	8 (16.3)	3 (18.8)	0.8224
Abdominal pain	9 (13.9)	5 (10.2)	4 (25.0)	0.1368
WBC at admission, ×10 ³ /mm ³	11.78 ± 7.22	10.85 ± 6.43	14.22 ± 8.79	0.1541
CRP at admission, mg/L	6.34 ± 9.53	5.43 ± 7.04	8.37 ± 13.79	0.3810
Albumin	3.74 ± 0.66	3.85 ± 0.63	3.45 ± 0.69	0.0718
Antibiotics				0.6510
None	6 (9.2)	5 (10.2)	1 (6.3)	
Cephalosporin	27 (41.5)	21 (42.9)	6 (37.5)	
Metronidazole	4 (6.2)	2 (4.1)	2 (12.5)	
Cephalosporin/Metronidazole	16 (24.6)	13 (26.5)	3 (18.7)	
Others	12 (18.5)	8 (16.3)	4 (25.0)	
Culture				0.0506
<i>Escherichia coli</i>	24 (36.9)	14 (28.5)	10 (62.5)	
<i>Klebsiella pneumoniae</i>	13 (20.0)	11 (22.5)	2 (12.5)	
Others	28 (43.1)	24 (49.0)	4 (25.0)	
ESBL	17 (27.0)	11 (23.4)	6 (37.5)	0.2726
Carcinoma				
Endometrium	0	0	0	
Cervix	0	0	0	

Data are presented as n (%) or mean ± standard deviation.

p-value < 0.05 was considered statistically significant.

ECOG, Eastern Cooperative Oncology Group; WBC, White blood cell; CRP, C-reactive protein; ESBL, Extended spectrum beta lactamase.

exhibited a significantly increased risk of recurrence (odds ratio (OR): 4.714, 95% confidence interval (CI): 1.086–20.470, $p < 0.05$).

The other variables did not significantly affect the risk of recurrence in the multiple regression analysis.

4. Discussion

We analyzed the clinical features of 65 pyometra patients at a single institution. About half of these patients were admitted to nursing facilities, and more than half of these patients had mobility problems. Vaginal discharge

was the most common symptom, while *E. coli* was the most commonly detected microorganism. The most common procedure was drainage; however, that left a risk of recurrence because the uterus was not typically removed. This is the first study to investigate the clinical features of pyometra and analyze risk factors for its recurrence. It was found that detecting *K. pneumoniae* in the abscess cultures increased the risk of recurrence by about four times.

In one previous study, *Bacteroides fragilis* (*B. fragilis*), *Streptococcus species*, and *Escherichia coli* were commonly isolated organisms [6]. In other studies, *E. coli*

Table 2. Univariate and multivariate logistic regressions for the risk of recurrent pyometra.

Variable		Crude Odds Ratio (95% CI) <i>p</i> value		Multivariate Odds Ratio (95% CI) <i>p</i> value	
Age		1.021 (0.980–1.064)		0.3294	
Nursing facility	Yes	2.045 (0.595–7.028)		0.2558	
	No	1			
Comorbidity					
Hypertension	Yes	1.453 (0.467–4.526)		0.5188	
	No	1			
Diabetes mellitus	Yes	0.639 (0.157–2.609)		0.5329	
	No	1			
Dementia	Yes	2.933 (0.680–12.650)		0.1490	
	No	1			
ECOG performance status score	2–4	1.517 (0.457–5.041)		0.4963	
	0–1	1			
Symptom					
Fever >38 °C	Yes	2.933 (0.680–12.650)		0.1490	
	No	1			
Culture					
	<i>Escherichia coli</i>	1.091 (0.173–6.878)	0.4460	1.630 (0.232–11.454)	0.7406
	others	1		1	
	<i>Klebsiella pneumoniae</i>	4.286 (1.129–16.266)	0.0242	4.714 (1.086–20.470)	0.0463
	others	1		1	
ESBL	Yes	1.1964 (0.582–6.629)		0.2770	
	No	1			

p-value < 0.05 was considered statistically significant.

ECOG, Eastern Cooperative Oncology Group; ESBL, Extended spectrum beta lactamase; CI, Confidence interval.

and *B. fragilis* were generally reported to be the most common causative organisms. Other causative agents included *Klebsiella*, *Streptococcus*, *Staphylococcus*, *Acinetobacter*, *Porphyromonas*, *Enterococcus*, and *Actinomyces* species [14]. Because the previous studies focused on uterine perforation, those results might differ from the results of the present study. In our results, *E. coli* was the most common pathogen detected, followed by *K. pneumoniae* (20.0%). *Enterococcus* and *Streptococcus* species also showed growth in the uterine abscesses (data not shown).

K. pneumoniae was first isolated in 1882 from the lungs of patients with pneumonia. It is a Gram-negative encapsulated bacterium [15]. It is ubiquitous in nature, and it resides in places including soils, surface waters, and mucosal surfaces such as the gastrointestinal tracts of mammals [16]. As an opportunistic pathogen, *K. pneumoniae* is involved in the vast majority of immunocompromised individuals and hospital-associated infections. It typically affects humans and commonly causes urinary tract infections, pneumoniae, surgical site infections, and life-threatening infections such as endocarditis and bloodstream infections [17]. Gynecologically, acute chorioamnionitis due to *K. pneumoniae* occurs in rare cases: four cases of such infections causing suppurative villitis and leading to fetal death in second trimester pregnancies have been reported [18–20]. *K. pneumoniae* accounts for 13.5% of the causative

bacteria in pelvic inflammatory diseases in women older than 45 years [21].

In the past, the uterus was considered to be a sterile organ, and the reproduction of microorganisms was thought to occur only in infections or pathological conditions [22]. However, next generation sequencing (NGS) has recently made it possible to analyze the genomes of microorganisms, and it has been found that there is a normal community of microorganisms in the uterus [23]. This is now being used to study chronic endometritis, endometrial hyperplasia or cancer, and it is also being used to identify the cause of infertility [24]. NGS research has identified potential molecular roles for endometrial microorganisms in cell metabolism, motility, genetic information, immune system, and signaling mechanisms. The presence of bacterial infections in the uterine cavity has been shown to contribute to chronic endometritis by causing the endometrial mucosa's continuous inflammation [25]. *Enterococcus faecalis*, *Enterobacteriaceae*, *Streptococcus spp.*, *Staphylococcus spp.*, *Gardnerella vaginalis*, *Mycoplasma spp.*, and other pathogens linked to sexually transmitted infections—like *Chlamydia trachomatis* and *Neisseria gonorrhoeae*—are the most frequently found bacteria that cause chronic endometritis [26]. With these advances in microbiome technology, future research into pyometra will likely continue to advance diagnostic and therapeutic approaches.

The most common symptom in our study was vaginal discharge. According to a literature analysis of patients with spontaneous perforation from pyometra [27], the most common symptoms were abdominal pain (92.1%), fever (52.6%), and vomiting (47.45%), with little vaginal discharge. However, as that study only considered patients with uterine perforation, it was inevitable that our results would differ from those.

Ultrasonography is the tool that is most commonly used to diagnose pyometra. The endometrial canal may include gas bubbles or an air-fluid level. However, because pyometra is a common disease in elderly patients with poor mobility, our findings show that its diagnosis is sometimes delayed. It is also often found incidentally on abdominal computed tomography. Transvaginal doppler ultrasound can be useful for diagnosing accompanying malignancy [28]. The standard treatment for recurrent pyometra is repeat drainage. However, definitive surgical management is recommended if an accompanying malignancy cannot be ruled out or the patient requires optimal treatment [29].

In our data, two out of 65 patients died due to septic shock accompanied by uterine perforation (data not shown). Several cases of spontaneous perforation caused by pyometra have been previously reported in the literature [27,28,30,31]. However, there has yet to be a systematic study on uterine perforation. The diagnosis of pyometra is often delayed, or it is misdiagnosed because its symptoms are vague, which can increase the risk of complications such as uterine perforation. Although pyometra is not typically a life-threatening disease by itself, perforation is a very dangerous disease with a mortality rate of up to 40% [12,14].

Pyometra is caused by occlusion of the cervical canal. It is mainly caused by malignant or benign tumors, surgery, or radiotherapy. However, since pelvic inflammatory disease can be chronic and progress to pyometra, the possibility of this disease should be kept in mind when considering premenopausal women [4]. Previous studies, which have mainly focused on patients with uterine perforation, have reported that about 26.2% of pyometra patients have malignant tumors [14]. In our study, no malignant tumors were found in any patients who underwent a cervical or endometrial biopsy. However, about half of our patients were admitted to nursing facilities, and 61.5% of our patients had limited physical activities. We did not investigate whether those patients urinated or defecated in a diaper, which could be a substantial factor in allowing retrograde bacteria to ascend up to the uterine cavity. A future study could expand upon this work by investigating the predictive value of pyometra.

5. Conclusions

In summary, pyometra is a rare disease. Because it is asymptomatic in most cases, gynecologic interest in it has been relatively low. However, as the number of elderly pa-

tients continues to increase along with the number of patients in nursing facilities, the frequency and severity of pyometra could also increase, thereby increasing its importance. In most cases, pyometra can be cured with drainage. However, caution is required when dealing with pyometra because it can be life-threatening if it is neglected or leads to complications such as uterine perforation. We found that the risk of pyometra recurrence increased depending on the causative organism. Future research should examine the risk factors and predictive value of pyometra.

Availability of Data and Materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Author Contributions

Conceptualization, Y-TO and HAL; Methodology, DYO, HH, TGA, SHN, JYH, and BL; Validation, CK and DL; Formal analysis, Y-TO, DYO, YHH, and SJL; Data curation, Y-TO; Writing—original draft preparation, Y-TO, DYO, TGA, SHN, JYH, and HAL; Writing—editing, SJL, TGA, SHN, JYH, and HAL; Supervision, TGA, SHN, JYH, and HAL. All authors have read and agreed to the published version of the manuscript. All authors contributed to editorial changes in the manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

Approval was obtained from the Institutional Review Board (IRB) of Kangwon National University Hospital before data extraction (IRB No. KNUH-A-2021-08-028). The requirement for informed consent was waived by the IRB due to the retrospective nature of this study.

Acknowledgment

Not applicable.

Funding

This study was supported by a 2020 Kangwon National University Hospital Grant.

Conflict of Interest

The authors declare no conflict of interest.

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