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Predictors for adverse outcomes and recurrence of pyometra: a 10-year retrospective study

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Objective: To identify predictors for adverse outcomes and recurrence in patients with pyometra.
Methods: Medical records of patients with a diagnosis of pyometra admitted to Tuen Mun Hospital between 1 January 2014 and 31 December 2023 were retrospectively reviewed. Patients' clinical characteristics, laboratory findings, management options, and clinical outcomes (including treatment- and disease-related complications and recurrence) were collected. Patients with or without composite adverse outcomes were compared, as were patients with or without recurrence. Multivariate logistic regression was used to determine independent predictors for composite adverse outcomes and recurrence.
Results: In total, 152 patients (median age, 79 years) were included in the analysis; the incidence of pyometra was 0.003%. Composite adverse outcome was more likely to occur in those with diabetes mellitus (adjusted odds ratio [aOR]=6.76, p=0.001) or congestive heart failure or a history of acute myocardial infarction (aOR=4.40, p=0.028), those with the longest diameter of the intrauterine pus collection (aOR=1.26, p=0.009), and those with extended-spectrum β-lactamase–positive bacteria (aOR=6.07, p=0.013), whereas composite adverse outcome was less likely to occur in those with vaginal bleeding (aOR=0.14, p=0.002). Of the patients, 24.0% had recurrence. The risk of recurrence increased with the presence of enterococci (aOR=3.31, p=0.022) and those with the longest diameter of the intrauterine pus collection (aOR=1.16, p=0.033).
Conclusion: Pyometra is rare and often associated with malignancy and severe complications. Patients at risk of developing adverse outcomes include those with diabetes mellitus, congestive heart failure or a history of acute myocardial infarction, large pus collection, and infection with extended-spectrum β-lactamase–producing organisms. Patients at risk of recurrence include those with a large pus collection or the presence of enterococci. At-risk patients should be monitored vigilantly. Early diagnosis and intervention are crucial to improving clinical outcomes.

Keywords: Bacteria; Pyometra; Recurrence

Introduction

Pyometra is the accumulation of pus in the uterine cavity caused by interference with its natural drainage[1,2]. The obstruction in the cervical canal can stem from a malignant or benign tumour, surgery, radiotherapy, or senile cervicitis[3]. Its incidence ranges from 0.01% to 0.5%[1,4,5]; it mainly occurs in postmenopausal women, with an incidence of 13.6%[5]. Pyometra has a possible association with malignancy; untreated cases may result in spontaneous uterine rupture, bacteraemia, pelvic abscess formation, generalised peritonitis, and septic shock[6-9].

Studies of pyometra primarily consist of case series and case reports. This study aimed to identify predictors for adverse outcomes and recurrence of pyometra and evaluate the microbial profile and antibiotic resistance of patients.

Methods

Medical records of patients with a diagnosis of pyometra admitted to Tuen Mun Hospital between 1 January 2014 and 31 December 2023 were retrospectively reviewed. Pyometra was defined as a uterine pus collection confirmed by both pelvic ultrasound and drainage of purulent discharge from the cervix. Patients with haematometra or hydrometra were excluded.

Patients' clinical characteristics, laboratory findings, management options, and clinical outcomes (including treatment- and disease-related complications and recurrence) were collected. The composite adverse outcome was defined as the presence of any of the disease-related complications (uterine rupture, sepsis, septic shock, intensive care unit admission, organ derangement, disseminated intravascular coagulopathy, emergency hysterectomy for pyometra, all-cause mortality at 28 days,

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and prolonged hospitalisation of ≥21 days). Treatment-related complications entailed drainage-related perforation and failure to drain. Recurrence was defined as any readmission for pyometra within 1 year. Sepsis was defined as an infection leading to organ dysfunction, as reflected by a SOFA (sequential organ failure assessment) score of ≥2[10]. Septic shock was defined as a requirement for vasopressors to maintain a mean arterial pressure of ≥65 mmHg and a serum lactate level of >2 mmol/L (>18 mg/dL), despite adequate fluid resuscitation[11]. Sepsis-induced coagulopathy was defined as a SOFA score of ≥4, based on platelet count and prothrombin time[12].

Patients with or without composite adverse outcomes were compared using the Student's *t* test or Mann-Whitney *U* test for continuous variables and the Chi-squared test or Fisher's exact test for categorical variables. Similarly, patients with or without recurrence were compared. Variables with a p value of <0.05 in the univariate analysis were included in the multivariate logistic regression to determine independent predictors for composite adverse outcomes and recurrence. Statistical analyses were performed using SPSS (Windows version 26.0; IBM Corp, Armonk [NY], United States). A p value of <0.05 was considered statistically significant.

Results

In total, 152 patients (median age, 79 years) were included in the analysis (Table 1). There were 43 959 gynaecological admissions during the study period, giving an incidence of 0.003%. Among the patients, 59.9% had impaired ambulation, 48.0% used incontinence pads regularly, and most had medical comorbidities.

Of 152 cultures, 55.9% grew ≥2 microorganisms (Table 2); 16.4% were extended-spectrum β-lactamase (ESBL)–producing bacteria, of which 96% were *Escherichia coli* and 4.0% were *Klebsiella* spp. Their isolate detection rates were 33.8% and 6.7%, respectively. Both ESBL-positive and -negative *E coli* strains had similar resistance rates to amoxicillin/clavulanic acid (co-amoxiclav) [7.1% and 6.4%, respectively, Table 3]. One ESBL-positive *E coli* isolate was resistant to second- and third-generation cephalosporins. Compared with ESBL-negative *E coli* isolates, ESBL-positive *E coli* isolates displayed higher antibiotic resistance against levofloxacin (56.5% vs 46.8%) and trimethoprim-sulfamethoxazole (41.7% vs 27.7%) and lower antibiotic resistance against gentamicin (16.7% vs 36.2%). ESBL-negative *Klebsiella* spp had a <20% resistance rate to most antibiotics, except for trimethoprim-sulfamethoxazole, whereas one ESBL-

Table 1. Clinical characteristics of patients with pyometra (n=152).

Characteristic	Value*
Age, y	79 (69-89)
Ethnicity	
Chinese	151 (99.3)
Pakistani	1 (0.7)
Menopause	148 (97.4)
Impaired ambulation	91 (59.9)
Incontinence pad use	73 (48.0)
Living in nursing home	63 (41.4)
Comorbidity	
Hypertension	98 (64.5)
Stroke	61 (40.1)
Diabetes mellitus	56 (36.8)
Dementia	44 (28.9)
Congestive heart failure / history of acute myocardial infarction	29 (19.1)
Chronic kidney disease	21 (13.8)
Osteoarthritis	10 (6.6)
Long-term medication	
Steroid	9 (5.9)
Other immunosuppressants	4 (2.6)
Previous pyometra	10 (6.6)
Intrauterine contraceptive device	6 (3.9)
Endometrial polyp	1 (0.7)
Submucosal fibroid	18 (11.8)
Neighbouring infections: pyosalpinx or tubo-ovarian abscess	6 (3.9)
Enteric or rectal fistula	3 (2.0)
Malignancy	37 (24.3)
Corpus	12 (7.9)
Cervix	21 (13.8)
Vagina	1 (0.7)
Double primary (ovary and corpus)	1 (0.7)
Colorectal	2 (1.3)
Instrumentation (hysteroscopy, dilatation, or curettage of uterus) within 1 year	3 (2.0)
History of loop electrosurgical excision procedure	3 (2.0)
History of pelvic radiotherapy	8 (5.3)
Any of the above	61 (40.1)
Clinical presentation	
Asymptomatic	9 (5.9)
Vaginal discharge	58 (38.2)
Abdominal pain	25 (16.4)
Fever	25 (16.4)
Maximum temperature, ˚C (in 25 women with fever)	38.3 (38-39)
Vaginal bleeding	97 (63.8)
Duration, d (in 117 symptomatic women)	10 (3-60)
Uterine size, wk	6 (6-8)

* Data are presented as median (interquartile range) or No. (%) of patients

Table 2. Laboratory findings of patients with pyometra (n=152).

Laboratory finding	Value*
Pyometra size on pelvic ultrasound	
Longest diameter, cm	2.8 (2.1-4.6)
Shortest diameter, cm	1.2 (1.0-2.3)
Laboratory parameters	
White cell count, $\times 10^9$/L (n=129)	8.1 (6.5-12.3)
Platelet, $\times 10^9$/L (n=129)	245 (187-323)
Urea, mmol/L (n=124)	5.2 (3.9-7.3)
Creatinine, μmol/L (n=124)	66 (57-83.8)
Alanine transaminase, U/L (n=119)	12 (8-16)
Alkaline phosphatase, U/L (n=119)	82 (70-101)
Bilirubin, μmol/L (n=119)	8 (6-10)
Albumin, g/L (n=119)	34 (31-38)
International normalised ratio (n=99)	1.1 (1.0-1.2)
Prothrombin time, s (n=99)	12.6 (11.8-13.7)
Activated partial thromboplastin time, s (n=99)	25.5 (24.1-27.9)
C-reactive protein, mg/L (n=75)	33 (3.7-107)
Positive culture	
Genital tract swab	124 (81.6)
Blood	4 (2.6)
Genital tract microorganisms	
Gram-positive bacteria	
Streptococci	35 (23.0)
Enterococci	19 (12.5)
Peptostreptococci	14 (9.2)
Peptoniphilus spp	14 (9.2)
Actinomyces spp	12 (7.9)
Staphylococci	8 (5.3)
Gram-negative bacteria	
Escherichia coli	71 (46.7)
Bacteroides spp	25 (16.4)
Klebsiella pneumoniae	15 (9.9)
Extended-spectrum β-lactamase positive	25 (16.4)
Fungus	
Candida spp	18 (11.8)
Others†	63 (41.4)
Polymicrobial (≥2 microorganisms)	85 (55.9)

* Data are presented as median (interquartile range) or No. (%) of participants

† Diphtheroids (3.9%), *Proteus mirabilis* (3.9%), *Prevotella* spp (3.9%), *Lactobacillus* spp (3.9%), *Clostridium* spp (3.3%), *Fusobacterium* spp (2.6%), *Actinobaculum* spp (2.6%), *Morganella morganii* (2.0%), *Citrobacter* spp (2.0%), *Porphyromonas* spp (2.0%), methicillin-resistant *Staphylococcus aureus* (1.3%), *Gardnerella vaginalis* (1.3%), *Haemophilus parainfluenzae* (1.3%), *Dialister micraerophilus* (1.3%), *Pseudomonas aeruginosa* (0.7%), *Bifidobacterium* spp (0.7%), *Parvimonas micra* (0.7%), *Trueperella bernardiae* (0.7%), *Providencia stuartii* (0.7%), anaerococci (0.7%), *Burkholderia cepacia* complex (0.7%), group A streptococci (0.7%), and commensals (0.7%)

positive *Klebsiella* isolate was sensitive to gentamicin, levofloxacin, and trimethoprim-sulfamethoxazole. No streptococcal isolates displayed antibiotic resistance against penicillin. For enterococci, 22.2% showed resistance to ampicillin and none to vancomycin. The most frequently used antibiotic regimen was co-amoxiclav and levofloxacin (57.2%), followed by co-amoxiclav and metronidazole (24.3%), levofloxacin and metronidazole (13.8%), and cefuroxime and metronidazole (12.5%). The median duration of antibiotic use was 14 days; 25% of patients required change of antibiotics upon availability of culture results (Table 4).

With regard to clinical management, 88.8% of patients were treated with endometrial aspiration, followed by antibiotics alone (5.9%), Foley drainage (2.6%), emergency hysterectomy (2.0%), and laparotomy with drainage (0.7%) [Table 4]. For the three patients with emergency hysterectomy, the first one underwent staging laparotomy and hysterectomy for an infected uterine tumour, pyometra, and pyosalpinx; the histopathological outcome was carcinosarcoma. The second patient presented with septic shock and underwent staging laparotomy and hysterectomy for an infected ovarian tumour and pyometra; the histopathological outcome was endometrioid adenocarcinoma involving the endometrium and ovary. The third patient had uterine rupture and septic shock secondary to pyometra and pyosalpinx. In the patient who underwent laparotomy with drainage, she presented with urosepsis and septic shock secondary to pyometra, uterine rupture, and tubo-ovarian abscess. There were seven (4.6%) treatment-related complications including drainage-related uterine perforation (n=2) and drainage failure (n=5).

A total of 33 (21.7%) patients had disease-related complications, particularly organ derangement (n=24), sepsis (n=15), and prolonged hospitalisation (n=13) [Table 4]. The rate of all-cause mortality at 28 days was 2.0% (n=3); all three patients had multiple comorbidities before admission. One patient was admitted for drug-related acute kidney injury. Imaging examination incidentally revealed pyometra, and drainage was performed. The patient had cardiac arrest and died despite resuscitation. The remaining two patients died of sepsis resulting from pyometra and other coexisting infections (urinary tract infection, pneumonia, and right-leg infective collection).

Composite adverse outcome was more likely to occur in those with diabetes mellitus (adjusted odds ratio [aOR]=6.76, p=0.001) or congestive heart failure / a history of acute myocardial infarction (aOR=4.40, p=0.028), those

Table 3. Antibiotic resistance of extended-spectrum β-lactamase (ESBL)–positive and –negative bacteria.

Antibiotic	Streptococci (n=35)		Enterococci (n=19)		ESBL-negative *Escherichia coli* (n=47)		ESBL-positive *Escherichia coli* (n=24)		ESBL-negative *Klebsiella Pneumoniae* (n=14)		ESBL-positive *Klebsiella Pneumoniae* (n=1)	
	No. of patients	Drug resistance, %	No. of patients	Drug resistance, %	No. of patients	Drug resistance, %	No. of patients	Drug resistance, %	No. of patients	Drug resistance, %	No. of patients	Drug resistance, %
Ampicillin	-	-	18	22.2	-	-	-	-	-	-	-	-
Penicillin	35	0	1	0	-	-	-	-	-	-	-	-
Amoxicillin/clavulanic acid	-	-	1	0	47	6.4	14	7.1	14	7.1	-	-
Second-generation cephalosporin	-	-	1	100	47	0	1	100	14	7.1	-	-
Third-generation cephalosporin	-	-	-	-	8	0	1	100	4	0	-	-
Fourth-generation cephalosporin	-	-	-	-	2	0	-	-	1	0	-	-
Gentamicin	-	-	1	100	47	36.2	24	16.7	14	7.1	1	0
Levofloxacin	2	0	1	0	47	46.8	23	56.5	14	14.3	1	0
Erythromycin	32	18.8	1	100	-	-	-	-	-	-	-	-
Clindamycin	14	28.6	-	-	-	-	-	-	-	-	-	-
Ticarcillin/clavulanic acid	-	-	-	-	47	0	-	-	14	7.1	-	-
Trimethoprim-sulfamethoxazole	21	4.8	-	-	47	27.7	24	41.7	14	21.4	1	0
Piperacillin/tazobactam	-	-	1	100	4	0	-	-	2	0	-	-
Amikacin	-	-	-	-	4	0	9	0	2	0	-	-
Ertapenem	-	-	-	-	1	0	4	25	-	-	-	-
Imipenem	-	-	-	-	2	0	5	0	1	0	-	-
Meropenem	-	-	-	-	2	0	4	0	1	0	-	-
Vancomycin	-	-	17	0	1	0	-	-	-	-	-	-
Cefoperazone/sulbactam	-	-	-	-	2	0	-	-	1	0	-	

with the longest diameter of the intrauterine pus collection (aOR=1.26, p=0.009), and those with ESBL-positive bacteria (aOR=6.07, p=0.013), whereas composite adverse outcome was less likely to occur in those with vaginal bleeding (aOR=0.14, p=0.002) [Table 5].

Of the patients, 24.0% had recurrence, and the median time interval from the index admission to recurrence was 1 (interquartile range, 0.6-2.8) month. The risk of recurrence increased with the presence of enterococci (aOR=3.31, p=0.022) and those with the longest diameter of the intrauterine pus collection (aOR=1.16, p=0.033) [Table 6].

Discussion

Pyometra is a rare condition that mainly affects older women; 74.1% of cases are idiopathic[1]. It probably results from genital atrophy, compounded by poor immunity and suboptimal hygiene[5]. In our study, malignancy was the most common predisposing factor, present in 24.3% of patients. Malignancy may distort intrauterine anatomy and obstruct outflow tract drainage; cervical cancer was the most frequently identified cancer.

In our study, 21.7% of patients had disease-related complications; 3.9% had septic shock, which is lower than the 14.6% reported in a study in South Korea, although it

Table 4. Management and clinical outcomes of patients with pyometra (n=152).

Outcomes	Value*
Management	
Endometrial drainage	135 (88.8)
Foley drainage	4 (2.6)
Antibiotics alone	9 (5.9)
Hysterectomy	3 (2.0)
Laparotomy and drainage	1 (0.7)
Antibiotic regimen	
Co-amoxiclav + metronidazole	37 (24.3)
Levofloxacin + metronidazole	21 (13.8)
Co-amoxiclav + levofloxacin	87 (57.2)
Cefuroxime + metronidazole	19 (12.5)
Ceftriaxone + metronidazole	9 (5.9)
Piperacillin/tazobactam	15 (9.9)
Vancomycin	6 (3.9)
Carbapenem	16 (10.5)
Pre-drainage antibiotics (n=140; excluding those with antibiotics alone and hysterectomy)	124 (88.6)
Duration of antibiotics, d	14 (14-14)
Disease-related complications	
Uterine rupture	2 (1.3)
Sepsis	15 (9.9)
Septic shock	6 (3.9)
Intensive care unit admission	2 (1.3)
Organ derangement	24 (15.8)
Disseminated intravascular coagulopathy	7 (4.6)
All-cause mortality at 28 days	3 (2.0)
Emergency hysterectomy	3 (2.0)
Prolonged hospitalisation	13 (8.6)
Treatment-related complications	
Drainage-related perforation	2 (1.3)
Failure to drain	5 (3.3)
Recurrence (n=146; excluding those with mortality and hysterectomy)	35 (24.0)
Time interval of recurrence from index admission, m	1.0 (0.6-2.8)

* Data are presented as median (interquartile range) or No. (%) of patients

lacked a clear definition of septic shock[13]. In our study, four patients underwent emergency hysterectomy or laparotomy with drainage secondary to septic shock and/or uterine rupture. Such an association was also reported in the study in South Korea[13]. The morbidity and mortality rates were high when pyometra was complicated with uterine rupture and subsequent peritonitis[14,15]. The poor prognosis was partly attributed to the non-specific clinical presentations, leading to misdiagnosis and delayed management. Therefore, pyometra with uterine rupture should be considered in patients with haemodynamic instability and early intervention is imperative.

Cervical stenosis predisposes patients to recurrence. The incidence of recurrence has been reported to be 22% to 31.4%[4,16]. It was 24.6% in patients treated in a single hospital in South Korea between 2010 and 2021[17]. Similarly, our patients were predominantly treated with endometrial drainage, which yielded a recurrence rate of 24.0%. However, another South Korean study in 2024 reported a recurrence rate of 6.3%[13]. The lower recurrence rate can be attributed to the use of Foley catheter drainage[5,13]. Detection of recurrence can be affected by symptom severity, patient and caregiver awareness, and follow-up availability and duration.

Older women with chronic diseases and restricted mobility had an increased risk of pyometra[18]. Diabetes mellitus predisposes patients to immunosuppression, whereas congestive heart failure and a history of acute myocardial infarction reduce mobility. A Taiwanese study found that infection-related admissions in patients with heart failure were associated with higher mortality, decompensation, myocardial infarction, stroke, and worsened long-term prognosis[19]. Patients presenting with vaginal bleeding were less likely to experience adverse outcomes, because postmenopausal bleeding could prompt early medical attention and timely treatment, preventing complications. The longest diameter of the intrauterine pus collection was a predictor for both adverse outcomes and recurrence. Similarly, the incidence of septic shock increases with the longest diameter of pyometra, albeit not significantly in the multivariate analysis[13]. Pyometra size reflects disease severity, chronicity, and drainage interference; larger collections increase the risk of incomplete drainage and recurrence. We recommend monitoring with interval scans to ensure complete drainage and early detection of recurrence in patients with a large pyometra collection, thus improving outcomes and reducing complications.

Common causative organisms in the pus collection include *E coli*, *Bacteroides* spp, streptococci, peptostreptococci, and *Klebsiella pneumoniae*[5,13,17,18,20]. In a 2015 review in Hong Kong, *E coli*, *Bacteroides fragilis*, streptococci, and peptostreptococci were the most prevalent pathogens[5]. Our department does not routinely

Table 5. Predictors for adverse outcomes in patients with pyometra.

Variable	Without adverse outcomes (n=119)*	With adverse outcomes (n=33)*	Odds ratio (95% confidence interval)	p Value	Adjusted odds ratio (95% confidence interval)	p Value
Age, y	78 (68-88)	84 (71-90.5)	-	0.311	-	-
Menopause	116 (97.5)	32 (97.0)	0.83 (0.08-8.23)	>0.99	-	-
Impaired ambulation	66 (55.5)	25 (75.8)	2.51 (1.05-6.02)	0.035	2.24 (0.62-8.04)	0.217
Incontinence pad use	55 (46.2)	18 (54.5)	1.40 (0.64-3.03)	0.397	-	-
Living in nursing home	47 (39.5)	16 (48.5)	1.44 (0.66-3.13)	0.354	-	-
Comorbidity						
Hypertension	75 (63.0)	23 (69.7)	1.35 (0.59-3.10)	0.479	-	-
Stroke	49 (41.2)	12 (36.4)	0.82 (0.37-1.81)	0.618	-	-
Diabetes mellitus	34 (28.6)	22 (66.7)	5.00 (2.19-11.42)	<0.001	6.76 (2.13-21.44)	0.001
Dementia	33 (27.7)	11 (33.3)	1.30 (0.57-2.98)	0.530	-	-
Congestive heart failure / history of acute myocardial infarction	18 (15.1)	11 (33.3)	2.81 (1.16-6.77)	0.019	4.40 (1.18-16.44)	0.028
Chronic kidney disease	15 (12.6)	6 (18.2)	1.54 (0.55-4.35)	0.403	-	-
Osteoarthritis	8 (6.7)	2 (6.1)	0.90 (0.18-4.43)	>0.99	-	-
Long-term medications						
Steroid	6 (5.0)	3 (9.1)	1.88 (0.45-7.97)	0.408	-	-
Other immunosuppressants	4 (3.4)	0	-	0.577	-	-
Previous pyometra	9 (7.6)	1 (3.0)	0.38 (0.05-3.13)	0.691	-	-
Presence of any predisposing factor	46 (38.7)	15 (45.5)	1.33 (0.61-2.88)	0.481	-	-
Clinical presentation						
Asymptomatic	9 (7.6)	0	-	0.207	-	-
Vaginal discharge	40 (33.6)	18 (54.5)	2.37 (1.08-5.19)	0.029	3.23 (1.03-10.14)	0.440
Abdominal pain	19 (16.0)	6 (18.2)	1.17 (0.43-3.22)	0.761	-	-
Fever	12 (10.1)	13 (39.4)	5.80 (2.31-14.52)	<0.001	1.97 (0.53-7.37)	0.314
Maximum temperature, ˚C (in 25 women with fever)	38.2 (37.7-38.6)	38.5 (38.1-39)	1.95 (0.68-5.64)	0.155	-	-
Vaginal bleeding	84 (70.6)	13 (39.4)	0.27 (0.12-0.60)	<0.001	0.14 (0.04-0.49)	0.002
Uterine size, wk	6 (6-8)	6 (6-12)	-	0.239	-	-
Pyometra size						
Longest diameter, cm	2.8 (2.0-3.8)	3.2 (2.2-8.9)	-	0.043	1.26 (1.06-1.50)	0.009
Genital tract microorganisms						
Gram-positive bacteria						
Streptococci	29 (24.4)	6 (18.2)	0.69 (0.26-1.84)	0.455	-	-
Enterococci	12 (10.1)	7 (21.2)	2.40 (0.86-6.70)	0.132	-	-
Peptostreptococci	9 (7.6)	5 (15.2)	2.18 (0.68-7.03)	0.186	-	-
Peptoniphilus spp	12 (10.1)	2 (6.1)	0.58 (0.12-2.71)	0.735	-	-
Actinomyces spp	8 (6.7)	4 (12.1)	1.91 (0.54-6.80)	0.293	-	-
Staphylococci	6 (5.0)	2 (6.1)	1.22 (0.23-6.32)	0.685	-	-
Gram-negative bacteria						
Escherichia coli	52 (43.7)	19 (57.6)	1.75 (0.80-3.81)	0.157	-	-
Bacteroides spp	18 (15.1)	7 (21.2)	1.51 (0.57-4.00)	0.404	-	-
Klebsiella pneumoniae	10 (8.4)	5 (15.2)	1.95 (0.62-6.15)	0.319	-	-
Extended-spectrum β-lactamase positive	15 (12.6)	10 (30.3)	3.01 (1.20-7.56)	0.015	6.07 (1.45-25.34)	0.013
Fungus						
Candida spp	8 (6.7)	10 (30.3)	6.03 (2.15-16.94)	<0.001	4.05 (0.92-17.86)	0.065
Polymicrobial (≥2 microorganisms)	62 (52.1)	23 (69.7)	2.12 (0.93-4.83)	0.072	-	-

* Data are presented as median (interquartile range) or No. (%) of patients

Table 6. Predictors for recurrence in patients with pyometra.

Variable	Without recurrence (n=111)*	With recurrence (n=35)*	Odds ratio (95% confidence interval)	p Value	Adjusted odds ratio (95% confidence interval)	p Value
Age, y	79 (69-88)	84 (71-90)	-	0.430	-	-
Menopause	108 (97.3)	35 (100)	-	>0.99	-	-
Impaired ambulation	62 (55.9)	25 (71.4)	1.98 (0.87-4.50)	0.102	-	-
Incontinence pad use	51 (45.9)	19 (54.3)	1.40 (0.65-3.00)	0.389	-	-
Living in nursing home	44 (39.6)	17 (48.6)	1.44 (0.67-3.09)	0.350	-	-
Comorbidity						
Hypertension	73 (65.8)	23 (65.7)	1.00 (0.45-2.22)	0.996	-	-
Stroke	40 (36.0)	19 (54.3)	2.11 (0.98-4.55)	0.055	-	-
Diabetes mellitus	39 (35.1)	14 (40.0)	1.23 (0.56-2.69)	0.602	-	-
Dementia	30 (27.0)	13 (37.1)	1.60 (0.71-3.56)	0.252	-	-
Congestive heart failure / history of acute myocardial infarction	23 (20.7)	3 (8.6)	0.36 (0.10-1.28)	0.101	-	-
Chronic kidney disease	15 (13.5)	4 (11.4)	0.83 (0.26-2.67)	>0.99	-	-
Osteoarthritis	5 (4.5)	4 (11.4)	2.74 (0.69-10.81)	0.218	-	-
Long-term medications						
Steroid	7 (6.3)	2 (5.7)	0.90 (0.18-4.55)	>0.99	-	-
Immunosuppressants	4 (3.6)	0	-	0.573	-	-
Previous pyometra	7 (6.3)	3 (8.6)	1.39 (0.34-5.70)	0.703	-	-
Presence of any predisposing factor	44 (39.6)	13 (37.1)	0.90 (0.41-1.97)	0.792	-	-
Uterine size, wk	6 (6-8)	6 (6-10)	-	0.145	-	-
Pyometra size						
Longest diameter, cm	2.8 (2.1-3.8)	3.4 (2.3-7.1)	-	0.045	1.16 (1.01-1.32)	0.033
Genital tract microorganisms						
Gram-positive bacteria						
Streptococci	24 (21.6)	10 (28.6)	1.45 (0.61-3.43)	0.396	-	-
Enterococci	10 (9.0)	9 (25.7)	3.50 (1.29-9.49)	0.019	3.31 (1.19-9.20)	0.022
Peptostreptococci	10 (9.0)	4 (11.4)	1.30 (0.38-4.45)	0.743	-	-
Peptoniphilus spp	10 (9.0)	4 (11.4)	1.30 (0.38-4.45)	0.743	-	-
Actinomyces spp	7 (6.3)	5 (14.3)	2.48 (0.73-8.37)	0.160	-	-
Staphylococci	6 (5.4)	2 (5.7)	1.06 (0.20-5.51)	>0.99	-	-
Gram-negative bacteria						
Escherichia coli	48 (43.2)	20 (57.1)	1.75 (0.81-3.77)	0.151	-	-
Bacteroides spp	21 (18.9)	4 (11.4)	0.55 (0.18-1.74)	0.305	-	-
Klebsiella pneumoniae	11 (9.9)	4 (11.4)	1.17 (0.35-3.95)	0.757	-	-
Extended spectrum β-lactamase positive	20 (18.0)	4 (11.4)	0.59 (0.19-1.85)	0.359	-	-
Fungus						
Candida spp.	14 (12.6)	2 (5.7)	0.42 (0.09-1.95)	0.359	-	-
Polymicrobial (≥2 microorganisms)	61 (55.0)	23 (65.7)	1.57 (0.71-3.47)	0.262	-	-
Management options			-	0.483	-	-
Endometrial drainage	99 (89.2)	34 (97.1)				
Foley drainage	3 (2.7)	1 (2.9)				
Antibiotics alone	7 (6.3)	0				
Laparotomy and drainage	1 (0.9)	0				
Composite adverse outcomes	22 (19.8)	5 (14.3)	0.67 (0.24-1.94)	0.462	-	-

* Data are presented as median (interquartile range) or No. (%) of patients

test for sexually transmitted pathogens because most of our patients had impaired ambulation and lived in nursing facilities[13]. The microbial data of our patients suggest that the pyometras originate from gastrointestinal tract and urinary tract pathogens.

Infection with ESBL-producing Enterobacteriaceae is associated with adverse outcomes and thus higher mortality rate, treatment failure, longer hospital stays, and greater hospital expenses[21,22]. Correct empirical antibiotic use is a key contributor; treatment with carbapenem results in significantly lower mortality (3.7%), compared with quinolones (36.3%), cephalosporins (40%), and β-lactam/β-lactamase inhibitors (50%)[21]. The high efficacy of carbapenems against ESBL strains is the result of minimal hydrolysis by ESBL enzymes and reduced susceptibility to the inoculum effect[21,23]. In Hong Kong, the IMPACT guideline supports carbapenem as the preferred agent for serious ESBL-positive infections[24], as reflected in the low resistance rate in our study.

In our study, enterococci were associated with higher recurrence rates. As gut commensals and opportunistic pathogens, they exhibit resilience, antibiotic resistance, and biofilm formation, complicating treatment and leading to recurrent infections[25,26]. Risk factors for enterococcal overgrowth include prolonged hospitalisation, urinary catheterisation, and repeated antibiotic use[25,26], which were common in our patients. Efforts to reduce enterococcal colonisation should include judicious antibiotic use, enhanced surveillance, and preventive measures to minimise transmission[26].

In our study, polymicrobial cultures were present in 55.9% of our patients. Postmenopausal changes, including reduced lactobacilli and increased anaerobes, result in vaginal flora dysbiosis and predisposition to polymicrobial infections[27]. Therefore, broad-spectrum antibiotics should be prescribed to target common pathogens, particularly anaerobes. Co-amoxiclav, levofloxacin, cefuroxime, and metronidazole were the common antibiotics used in our patients. Co-amoxiclav provides good coverage for both Gram-positive and Gram-negative bacteria. Metronidazole primarily targets anaerobes, which are common in female genital tract infections[28]. High quinolone resistance among *E coli* (50% in our patients and 40% in Hong Kong[24]) raises concerns about levofloxacin as a viable option. Our study supports the suitability of cefuroxime for ESBL-negative infections, but it is ineffective against ESBL-positive strains, consistent with guidelines in Hong Kong[24].

In Hong Kong, co-amoxiclav and metronidazole would be a reasonable empirical regimen for pyometra, whereas carbapenem should be reserved for severe ESBL-positive infections. Duration of antibiotic use must be customised to individual needs. A microbiologist's input should be considered in patients with recurring pyometra or non-responders to antibiotics.

Our study has several limitations. Only inpatients were included; milder cases of pyometra managed in an outpatient setting were excluded. This selection bias potentially overestimates the severity and frequency of adverse outcomes. Consequently, generalisation of our findings to all pyometra cases is limited. Additionally, subgroup analysis for each adverse outcome was not feasible owing to the small sample size. The retrospective nature of the study is affected by missing data and loss to follow-up. Prospective randomised controlled trials are needed to determine the most optimal management strategies for improvement of clinical outcomes.

Conclusion

Pyometra is rare and often associated with malignancy and severe complications. Patients at risk of developing adverse outcomes include those with diabetes mellitus, congestive heart failure or a history of acute myocardial infarction, large pus collection, and infection with ESBL-producing organisms. Patients at risk of recurrence include those with large pus collection or the presence of enterococci. At-risk patients should be monitored vigilantly. Early diagnosis and intervention are crucial to improving clinical outcomes.

Contributors

All authors designed the study, acquired the data, analysed the data, drafted the manuscript, and critically revised the manuscript for important intellectual content. All authors had full access to the data, contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity.

Conflicts of interest

All authors have no conflict of interest to disclose.

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Data availability

All data generated or analysed during the present study are available from the corresponding author upon reasonable request.

Ethics approval

The present study was approved by the Central Institutional Review Board of Hospital Authority (reference: IRB-2024-276). All patients were treated in accordance with the tenets of the Declaration of Helsinki.

References

1. Chan LY, Lau TK, Wong SF, Yuen PM. Pyometra. What is its clinical significance? J Reprod Med 2001;46:952-6.
2. Muram D, Drouin P, Thompson FE, Oxorn H. Pyometra. Can Med Assoc J 1981;125:589-92.
3. Li CH, Chang WC. Spontaneous perforated pyometra with an intrauterine device in menopause: a case report. Jpn J Infect Dis 2008;61:477-8. Crossref
4. Whiteley PF, Hamlett JD. Pyometra: a reappraisal. Am J Obstet Gynecol 1971;109:108-12. Crossref
5. Lui MW, Cheung VY, Pun TC. Clinical significance of pyometra. J Reprod Med 2015;60:329-32.
6. Sala A, Restaino S, De Carlo C, et al. Postoperative *Streptococcus constellatus* bacteremia in a 75-year-old patient with pyometra: a case report. Am J Case Rep 2021;22:e931167. Crossref
7. Krishna N, Aggarwal K, Lal P, Singh A. Postmenopausal idiopathic spontaneous rupture of pyometra with tubo-ovarian abscess: an atypical presentation. J Midlife Health 2024;15:112-4. Crossref
8. Malvadkar SM, Malvadkar MS, Domkundwar SV, Mohd S. Spontaneous rupture of pyometra causing peritonitis in elderly female diagnosed on dynamic transvaginal ultrasound. Case Rep Radiol 2016;2016:1738521. Crossref
9. Matsumoto R, Kuramoto S, Muronoi T, et al. Damage control surgery for spontaneous perforation of pyometra with septic shock: a case report. Acute Med Surg 2021;8:e657. Crossref
10. Vincent JL, de Mendonca A, Cantraine F, et al. Use of the SOFA score to assess the incidence of organ dysfunction/failure in intensive care units: results of a multicenter, prospective study. Working group on "sepsis-related problems" of the European Society of Intensive Care Medicine. Crit Care Med 1998;26:1793-800. Crossref
11. Singer M, Deutschman CS, Seymour CW, et al. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). JAMA 2016;315:801-10. Crossref
12. Iba T, Levi M, Thachil J, Levy JH. Disseminated intravascular coagulation: the past, present, and future considerations. Semin Thromb Hemost 2022;48:978-87. Crossref
13. Jang S, Jeon M, Mun SJ, Kim SH. Clinical characteristics and risk factors for septic shock in patients with pyometra: a retrospective multicenter cohort study. J Infect Public Health 2024;17:862-7. Crossref
14. Lee SMJ, Kim YS, Kim MJ, Kim SJ. Spontaneous uterine perforation due to pyometra presenting as acute abdomen in older age. Korean J Obstet Gynecol 2010;53:377-80. Crossref
15. Yazawa H, Imaizumi K. Generalized peritonitis secondary to spontaneously perforated pyometra in elderly women: two cases with different clinical courses and surgical approaches and review of the literature. Fukushima J Med Sci 2020;66:53-9. Crossref
16. Rasmussen KL, Petersen AC. Pyometra without accompanying malignant uterine disease [in Danish]. Ugeskr Laeger 1990;152:1822-3.
17. Ouh YT, Oh DY, Hong H, Lee B, et al. Clinical characteristics of pyometra: eleven years of experience from a single institution. Clin Exp Obstet Gynecol 2023;50:130. Crossref
18. Ou YC, Lan KC, Lin H, Tsai CC, ChangChien CC. Clinical characteristics of perforated pyometra and impending perforation: specific issues in gynecological emergency. J Obstet Gynaecol Res 2010;36:661-6. Crossref
19. Chen CY, Lee CH, Lin HW, Lin SH, Li YH. Impact of infection-related admission in patients with heart failure: a 10 years national cohort study. Sci Rep 2023;13:6941. Crossref
20. Ikeda M, Takahashi T, Kurachi H. Spontaneous perforation of pyometra: a report of seven cases and review of the literature. Gynecol Obstet Invest 2013;75:243-9. Crossref
21. Paterson DL, Ko WC, Von Gottberg A, et al. Antibiotic therapy for *Klebsiella pneumoniae* bacteremia: implications of production of extended-spectrum beta-lactamases. Clin Infect Dis 2004;39:31-7. Crossref
22. Lautenbach E, Patel JB, Bilker WB, Edelstein PH, Fishman NO. Extended-spectrum beta-lactamase-producing *Escherichia coli* and *Klebsiella pneumoniae*: risk factors for infection and impact of resistance on outcomes. Clin Infect Dis 2001;32:1162-71. Crossref
23. Winokur PL, Canton R, Casellas JM, Legakis N. Variations in the prevalence of strains expressing an extended-spectrum beta-lactamase phenotype and characterization of isolates from Europe, the Americas, and the Western Pacific region. Clin Infect Dis 2001;32(Suppl 2):S94-103. Crossref
24. Ho PLW, TC, Chao DVK, Hung IFN, et al. Reducing bacterial resistance with IMPACT, 5th edition, Hong Kong; 2017.
25. Xu W, Fang Y, Zhu K. Enterococci facilitate polymicrobial infections. Trends Microbiol 2024;32:162-77. Crossref
26. Sangiorgio G, Calvo M, Migliorisi G, Campanile F, Stefani S. The impact of enterococcus spp. in the immunocompromised host: a comprehensive review. Pathogens 2024;13:409. Crossref
27. Muhleisen AL, Herbst-Kralovetz MM. Menopause and the vaginal microbiome. Maturitas 2016;91:42-50. Crossref
28. Brook I. Spectrum and treatment of anaerobic infections. J Infect Chemother 2016;22:1-13. Crossref