Intra-abdominal sepsis in women over 60 years of age. Experience 2020 to 2022 of a High Specialty Hospital in Mexico City

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Background
Intra-abdominal sepsis increases morbidity and mortality in older adult patients. Data in older women receiving intensive care may be different.
Objective: To know the experience in the diagnosis, management and outcome of women over 60 years of age with intra-abdominal sepsis admitted to the Intensive Care Unit (ICU) of a high specialty hospital in Mexico City.
Material and methods: Observational, longitudinal, retrospective, descriptive and analytical study in a cohort of 21 women over 60 years of age with intra-abdominal sepsis admitted to the ICU between 2020 and 2022. The records were reviewed to know the general data, origin of sepsis, associated factors, bacteriology, antibiotic therapy, surgical reinterventions, prognostic scales, length of stay in the ICU and mortality.
Results: Age 70.7±8.5 years, morbidities 95.2% (cancer 71.4%, diabetes 66.7%, hypertension 61.9%). Origin of sepsis: pelvic abscess 38.1% and intestinal pathology 33.3%. Responsible microorganism: Escherichia coli in 28.6%. Imipenem was used in 28.6% as monotherapy. Twenty surgical reinterventions were documented 95.2% (washing of the infected surgical wound with closure of the abdominal wall 33.4%, drainage of abscesses, cavity washings 19% and repair of colostomies 19%). Prognostic scales: qSOFA 1.8, SOFA 3.29 and APACHE II 5.57 points. Stay in the ICU 4.94±0.93 days and mortality 28.6%.
Conclusions: The presence of cancer, diabetes, pelvic abscess and high percentage of reinterventions were the characteristics of the cohort. Mortality was high related to cancer, reinterventions and the extreme severity of sepsis. Gender should be taken into account for the management of older patients with intra-abdominal sepsis.

Keywords: Intra-abdominal sepsis; Intra-abdominal infection; Sepsis and surgery; Sepsis in elderly women; Sepsis and intensive care.

The conditions of modern life have made it possible for women to reach increasingly older ages. [1] The physiological changes of advanced age and the effect of chronic morbidities increase the risk of cardiovascular, metabolic, neoplastic and infectious complications, among which sepsis stands out.[2,3]

Sepsis is defined as a life-threatening organ dysfunction caused by a dysregulation of the host response to infection that involves early activation of pro- and anti-inflammatory responses along with important modifications in non-immunological pathways such as cardiovascular, neuronal, autonomic, hormonal, bioenergetics, metabolic and coagulation. Septic shock is defined as sepsis with the need to use a vasopressor agent to maintain mean arterial pressure ≥ 65 mmHg and prevent serum lactate concentration from being ≥ 2 mmol/L.[4]

Sepsis and septic shock represent a challenge for the medical team in hospitals due to the great complexity of their pathophysiology, molecular mechanisms, immunosenescence, the influence of genetic load and the variants of their clinical presentation. [5,6] Its incidence has increased continuously since the first consensus for its definition (Sepsis-1) was carried out in 1991. [7,8] The increase has been attributed to the greater number of patients reaching advanced age, the increase in invasive procedures, the wide use of immunosuppressive drugs and chemotherapy, and antibiotic resistance. [9]

In relation to the frequency of the microorganisms responsible for sepsis and septic shock, Gram-positive bacteria (Staphylococcus aureus and Streptococcus pneumoniae), fungi (Candida spp) and Gram-negative bacteria (Escherichia coli, Klebsiella, Pseudomonas spp) are the predominant

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Parameters	No. cases n=21	Percentage
Cultivation site		
Surgical wound	10	47.6
Bronchial secretion	4	19.1
Drains	3	14.3
Urine	2	9.5
Blood	2	9.5
Microorganisms		
Escherichia coli	6	28.6
Enterococcus sp	2	9.5
Klebsiella pneumoniae	2	9.5
Pseudomona aeruginosa	2	9.5
Staphilococus aureus	2	9.5
Staphilococus epidermidis	1	4.8
Streptococus haemolyticus	1	4.8
None	5	23.8

Table 1. Bacteriological identification in cultures.

agents.[10] The main sites of infection include the respiratory tract (lung parenchyma) 43%, urinary system 16%, abdomen 14%, head (associated with fever of unknown origin) 14% and other sites 13%.[9,10] According to the third international consensus on sepsis and septic shock (Sepsis-3), a rapid evaluation of sequential organ failure with the qSOFA scale (quick Sequential Organ Failure Assessment) should be considered in all cases. [4] The 2021 guidelines recommend the NEWS scale (National Early Warning Score) or the SIRS scale (systemic inflammatory response syndrome). The extended SOFA (Sequential Organ Failure Assessment) scale and APACHE II (Acute Physiology and Chronic Health Evaluation II) are additional tools. [6]

Septic patients have a high risk of mortality, representing 20% of in-hospital deaths from all causes, making sepsis one of the most lethal conditions. [8,11] Sepsis and septic shock can occur in patients of any age, their incidence is increasing disproportionately in the older adult population. [3] Martin et al. [12] have documented that advanced age is an independent factor in mortality from sepsis. Complications and high mortality have been recorded in older patients with previous hospitalizations [13] and in patients admitted to the Emergency department and Intensive Care Unit (ICU).[14,15]

Previous research has not considered that the results may be different not only with respect to advanced age but also gender because women can suffer from diseases of their internal sexual organs that do not exist in men. In addition, intensive care may also influence the results. Given this situation, the **objective** of the present investigation was to know the experience in the diagnosis, management and outcome of patients aged 60 years or older with intra-abdominal sepsis admitted to the ICU of a tertiary care center for women in Mexico City.

Regimens	No. cases n=21	%
Imipenem as single agent	6	28.6
Imipenem / Ciprofloxacin	3	14.3
Cefotaxime as single agent	1	4.8
Cefotaxime + Metronidazole / Metronidazole + Levofloxacin / Imipenem	1	4.8
Cefotaxime + Metronidazole / Imipenem / Dicloxacillin	1	4.8
Cefotaxime + Metronidazole / Imipenem	1	4.8
Imipenem + Metronidazole / Fluconazole	1	4.8
Imipenem + Metronidazole / Ciprofloxacin / Amikacin	1	4.8
Imipenem / Clindamycin	1	4.8
Imipenem / Metronidazole	1	4.8
Levofloxacin + Metronidazole / Imipenem	1	4.8
Levofloxacin / Metronidazole	1	4.8
Meropenem / Imipenem	1	4.8
Meropenem/ Vancomycin	1	4.8

Table 2. Antibiotic regimens. The mark with a diagonal (/) separates one regimen from another

Methods

An observational, longitudinal, retrospective, descriptive and analytical study was carried out in ICU patients of a High Specialty Medical Unit in Mexico City (Gynecology and Obstetrics Hospital No. 3 of the National Medical Center "La Raza", Mexican Institute of Social Security) admitted in the years 2020 to 2022. All patients with a diagnosis of intra-abdominal sepsis, aged 60 years or older, and with any morbidity were included. All patients came from the operating rooms of the same hospital where they underwent their first abdominal surgery and were then transferred to the ICU to receive intensive care. All surgical procedures were carried out by a gynecologist and a surgical oncologist with a subspecialty in gynecology. Patients who had already undergone surgery more than once at the host hospital or who had surgery at other hospitals and those with unavailable clinical records were excluded.

The diagnosis of sepsis was made when the patients met 2 of 4 criteria of the SIRS scale (1. Temperature >38.3°C or <36°C, 2. Heart rate >90 beats/minute, 3, Respiratory rate >20 breaths/minute or PaCO2 <32 mmHg from arterial blood gas,
4. White blood cell count >12,000 cells/µL), in addition to an intra-abdominal infection documented from clinical review supported by ultrasound, tomography or MRI studies within the 2 calendar days

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Case	Age	Morbidities	Previous hospitalizations	Reinterventions	Mechanic ventilation	Amines	Causes of death
1	70	DM type 2 Hypertension CKD COPD CUCA	Yes	1	Yes	Yes	MOF
2	77	DM type 2 Hypertension CKD COPD CUCA	Yes	2	Yes	Yes	Septic shock
3	72	Hypertension CKD COPD Ovarian cancer	Yes	1	Yes	Yes	Septic shock
4	62	DM type 2 COPD CUCA	None	1	None	None	Septic shock
5	72	DM tipo 2 CKD COPD Endometrial cancer	None	1	Yes	Yes	Septic shock
6	69	DM type 2 Hypertension CKD COPD CUCA	Yes	1	Yes	Yes	Septic shock

Table 3. Clinical characteristics in 6 cases of death. DM = Diabetes Mellitus, CKD = Chronic kidney disease, COPD = Chronic obstructive pulmonary disease. CUCA = Cervix-uterine carcinoma. MOF = Multiorgan failure

before and/or 2 calendar days after admission to the hospital. [4,6,8,10,16]

A cohort of 21 cases met the selection criteria. The clinical records were consulted to obtain the following information: age, morbidities, history of hospitalizations in the previous three months, anatomical site of origin of intra-abdominal sepsis, bacteriological identification with cultures, antibiotic therapy, surgical reinterventions, score of prognostic assessments (qSOFA, SOFA, APACHE II), mechanical ventilatory support, use of vasoactive amines, ICU stay and mortality.

To carry out the study, authorization was obtained from the Local Medical Research Committee and the Medical Research Ethics Committee of the host hospital (R-2022-3504-051).

For data analysis, descriptive statistics (mean, median, standard deviation, range). The paired Student's T test or the Mann-Whitney U test were used to compare continuous variables according to their distribution. The $p < 0.05$ value was considered significant. The statistical program SPSS™ version 24 was used.

Results

The mean age was 70.7±8.57 years (limits 60 to 91), only 14.28% (3 patients) were ≥ 80 years old. It was found that the mean body mass index (BMI) was 33±5.9. Morbidities were documented in 95.23% with the following distribution: obesity 76.19% (n=16), cancer 71.4% (n=15), type 2 diabetes mellitus 66.7% (n= 14), chronic hypertension 61.9% (n=13), chronic kidney disease without dialysis 14.3% (n=3), ischemic heart disease without heart failure 14.3% (n=3), Chronic obstructive pulmonary disease 14.3% (n=3) and inactive rheumatoid arthritis 4.8% (n=1). Specifically, with respect to the 15 patients with malignancies, endometrial adenocarcinoma was found in 38.1% (n=8), cervix-uterine carcinoma 19% (n=4), malignant small cell tumor with unknown primary site 4.8% (n= 1), ovarian cancer 4.8% (n=1) and malignant vaginal tumor 4.8% (n=1). A history of hospitalizations in the previous three months related to pelvic-abdominal infection was documented, which, at the time, did not require surgery in 38.1% (n=8).

Regarding the anatomical origin of sepsis, it was found that pelvic abscess was the most frequent site in 38.1% (n=8) followed by infection due to perforation of the colon and rectum 33.3% (n=7), surgical site infection and the abdominal wall due to failed colostomy 14.3% (n=3), perforation of the uterine body due to endometrial adenocarcinoma 8.4% (n=2) and emphysematous pyelonephritis 4.8% (n=1). Septic shock was documented in 42.9% (n=9). Culture sites and bacteriological identification are shown in **Table 1**. All patients had at least one culture during their stay in the ICU. The microorganism that was most frequently

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Author year country	Number of cases studied	Gender percentage Male Female	Mortality percentage (n)
Blot [18] 2019 Belgium	2621	56.9/43.1	29.1 (752)
Silva-Nunes [20] 2019 Portugal	154	48/52	18 (13)
Tolonen [21] 2019 Finland	283	47/53	10 (29)
Li [23] 2023 China	464	47.8/52.2	22.4 (104)
Vázquez Current 2024 Mexico	21	0/100	28.6 (6)

Table 4. Mortality in patients over 60 years of age with intra-abdominal sepsis.

identified in the cultures was Escherichia coli in 28.6% (n=6).

The antibiotic regimens selected for the management of sepsis and septic shock showed great diversity. However, a predilection for the use of Imipenem as simple therapy was observed in up to 28.6% (n=6). **Table 2**

It was found that twenty patients underwent one or more surgical reinterventions (95.2%), the most frequent reintervention was washing of infected surgical wound with closure of the abdominal wall in 33.4% (n=7) followed by drainage of abscesses 23.8 % (n=5), cavity lavages 19% (n=4) and colostomy repair 19% (n=4).

In relation to the prognostic assessments, the average of the qSOFA scale was 1.8 points, the extended SOFA assessment 3.29 points (corresponding to acute organic dysfunction at the time of admission to the ICU) and the APACHE II assessment 5.57 points. It was found that mechanical ventilatory support was required in 52.4% (n=11) and the use of vasoactive amines was necessary in 57.14% (n=12).

The average length of stay in the ICU was 4.94±0.93 days (15 surviving patients 6.04±1.18 days, 6 cases of death 2.11±0.41 days, p=0.006). Regarding the outcome, the frequency of mortality was 28.6% (n=6). **Table 3**

Discussion

The data reported about sepsis in older adult patients have emerged from the analysis of a database or from clinical studies considering all the causes of sepsis and always including patients of both genders. [9,12,13,15] For their part, reviews and international guidelines on the subject have not issued recommendations based on the gender of the patients. [2-8,10,11,14,16] The same has occurred with reviews and reports of clinical studies of intra-abdominal sepsis in elderly patients; researchers have not considered that there may be important differences in women. [17-23]

With this panorama, the data of a cohort of 21 women aged ≥ 60 years with intra-abdominal sepsis were reviewed to know the experience of the ICU belonging to a High Specialty Medical Unit in Mexico City once the reports in adult women are rare. It was also interesting to identify the similarities and differences with intra-abdominal sepsis research that includes both genders.

The mean age was 70.7±8.57 years, only three patients (14.28%) were ≥ 80 years old, which limited the analysis of the clinical course and outcome in very elderly patients (≥ 80 years), a group in which Martin-Loeches et al. [24] have reported the worst results.

A high percentage of morbidities was found (95.2%), the most important being cancer in 71.4% of the cases (mainly endometrial cancer and cervix-uterine carcinoma) and type 2 diabetes mellitus in 66.7%. For Yarmuch et al. [25] diabetes and cancer are determining factors of an adverse evolution because they alter the immune system of patients which increases the possibility of developing sepsis.

Prescott et al. [13] have reported that previous hospitalizations can induce an altered human microbiome particularly in patients receiving antibiotics. This change in bacterial flora has been associated with a three-fold increased risk of developing sepsis in the following 90 days. In the patients studied, it was found that the prevalence of previous hospitalizations that did not require surgery was 38.1% (8 cases), but the results of the previous cultures were not known to identify if there were changes in the flora because they were not requested in the majority of patients.

Infection of the abdominal cavity, as described by Sartelli et al. [22] comprises a wide spectrum of pathologies that can originate from any organ or intra-abdominal space. Farmer et al. [26] analyzed a database of 398 patients under 65 years of age and 120 patients aged 65 years or older of both genders. Both groups had intra-abdominal sepsis and received the same management. In older patients, different sites of intra-abdominal infection were found in relation to the cohort of younger patients. Colon and rectum (48.3% vs. 29.9%, p=0.0002) and the biliary tree (16.7% vs. 9.1%, p=0.02) were the most frequent sites in the older group while the small intestine (6.7% vs. 16.3%, p=0.008) and appendix (4.2% vs. 17.1%, p=0.0004) were more common in the younger group. Podnos et al. [17] reported that the most frequent causes of intra-abdominal sepsis in patients of both genders over 65 years of age were appendicitis 28%, diverticulitis 28%, cholecystitis 12%, cholangitis 12%, intra-abdominal abscess 9% and colon cancer-sigmoid volvulus-mesenteric ischemia 11%. In the cohort of 21 women studied, it was found that pelvic abscess was

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the most frequent site 38.1% followed by infection due to perforation of a tumor of the colon and rectum 33.3%, infection of the surgical site and the abdominal wall due to failed colostomies in patients with cervical cancer 14.3%, perforation of the uterine body due to endometrial cancer 8.4% and emphysematous pyelonephritis 4.8%.

It stands out that the sites of origin of intra-abdominal sepsis in the studied cohort were totally different compared to the series that include patients of both genders, this data is the first important contribution of the research. The second distinguishing characteristic was the presence of cancer (colon and rectum, endometrial adenocarcinoma, cervix-uterine carcinoma, ovarian cancer). The third relevant data is the high percentage of reinterventions 95.2% to repair colostomies with leaks or closure of the abdominal wall. Postoperative bleeding was not a cause of reinterventions. The fourth difference was that cancer was present in all cases of death. **Table 3** The fifth characteristic was the short stay in the ICU of the patients who died compared to the patients who survived.

In 2016, Rowe et al. [15] studied 309 patients aged ≥ 60 years of both genders who were admitted to the ICU. The objective of the research was to establish the association of sepsis with mortality and identify predictive factors. They found an increase in mortality in elderly patients with sepsis compared to that of cases without sepsis. The association of sepsis with mortality was reduced when patients were managed with early use of antimicrobial agents and vasoactive drugs. In the present cohort, the cultures were performed early and the results served to replace the antibiotics initially chosen empirically with other agents directed against intestinal bacteria among which Escherichia coli had a predominance of 28.6%. **Table 1** The escalation of antibiotics was carried out in accordance with international recommendations. [18-20,22] **Table 2** The use of vasoactive amines, mechanical ventilation assistance, and critical care did not make a difference in mortality.

The presence of septic shock was found in 42.9% of the patients studied, which means a high percentage of cases with extreme severity of sepsis since their admission to the ICU. This situation was possibly related to the delay in the decision to carry out early surgical intervention once some patients had presented clinical manifestations that led to previous hospitalizations.

qSOFA, SIRS, SOFA, APACHE II and NEWS are scales that are used to predict the clinical prognosis of critically ill patients, including cases with intra-abdominal infections. These are easily reproducible scores with high predictive value and easy application for the early identification of sepsis. Its usefulness has been reproduced in international studies. [27,28] In the 21 patients studied, the mean score on the qSOFA scale was 1.8, on the extended SOFA assessment 3.29, and on the APACHE II scale 5.57 points, which corresponded to only acute organic dysfunction. However, in the 21 cases studied, more than two failures were documented: mechanical ventilatory support was required in 52.4% and amines in 57.1% during their stay in the ICU, respectively. The discordance between the grade scores and the presence of organic failures warrants further specific studies. SIRS and NEWS scales were not taken into account by the ICU medical team; this data can be considered a deviation from international recommendations.[27,28]

The average stay in the ICU of the 21 patients studied was 4.94±0.93 days, the cases of death (28.6%, n=6) had a shorter stay in the ICU than the surviving patients (2.11±0.41 vs 6.04±1.18 days, p=0.006). This finding can be explained by the severity of sepsis and its complications (septic shock) in an adverse scenario due to a history of diabetes and the presence of intestinal and gynecological cancer. The extreme critical condition of the patients, the organic deterioration that did not improve with intensive care and the surgical reinterventions were possibly factors that conditioned the early death. The small number of deceased cases does not allow conclusions to be drawn. **Table 3** The 28.6% mortality of the cohort was similar to the percentage reported in other series of intra-abdominal sepsis despite the fact that the patients received intensive care. **Table 4**

Progress continues in the knowledge of the pathophysiology of intra-abdominal sepsis, its timely identification and in the non-invasive and surgical guidelines for its management. [8,17-23] However, it is necessary to document more evidence with research related to elderly patients and gender differences.

The main strengths of the present research are that the analysis of the data allowed us to learn about the experience in the diagnosis, management and outcome of patients aged ≥ 60 years with intra-abdominal sepsis in the ICU managed by a multidisciplinary medical team from a tertiary care center. Similarities and differences have also been identified with research that includes patients of both genders. The weaknesses of the study lie in its design, the case selection criteria and the characteristics of the hospital where the patients were treated, which limits establishing categorical conclusions, associations or causality.

Conclusion

The presence of cancer, diabetes, pelvic abscess and high percentage of reinterventions were the clinical characteristics of the cohort. A high percentage of mortality was found, the death cases

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were related with intra-abdominal cancer, surgical reinterventions, extreme severity of sepsis and short stay in the ICU. The group of older adult requires more research with a very particular focus on gender variety.

Conflicts of interest

The authors have no conflicts of interests to declare.

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