Original Article

The effect of multidrug-resistant infections in cancer hospital intensive care unit

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Abstract

Background: For millennia, health-care-associated infections (HAI) have had a negative impact on healthcare systems. Multidrug-resistant Infections (MDRI) have exacerbated the issue in recent years, owing to the abuse of standard antibiotics in dealing with bacterial infection concerns. The bacteria show adaptability in hostile living conditions by resisting most known antibiotics and their combinations. This imposes a new burden on the hospital's health care, especially for patients in the ICU. This risk is amplified when considering, cancer patients who are at greater risk of serious sepsis, Hospital acquired infection (HAI), and with a multi-drug resistant bacterium (MDRB). This is a global issue which needs to be addressed and should have a clear health policy to tackle this problem.

Objective: The goal of this study was to identify the infectious diseases', microbial and antibiotic resistance profiles, and their impact on the mortality of multi-drug resistant (MDR) infections in a range of distinct locales throughout the world.

Materials and Methods: A 5-year retrospective descripted HAI study on patients at the Mexican Oncology Center Intensive Care Unit was carried out from January 2007 until December 2011. Patient features and co-morbidities, the tumor and treatment data, microbiology, and patterns of pharmaceutical resistance of all isolates have been collected.

Results and Discussions: 1418 patients were treated by the intensive care unit during the study period, with 159 of them occurring every 3000 23.2 days in 134 infections with a frequency of 11.2 % of workers. There were 266 types of microorganisms. MDR-HAI 's gross incidence was 39.5%. The most common microorganisms are: 54 (20%) Escherichia Coli (94%); 32 (12%) Staphylococcus aureus (90% are methicillin-resistant); 32 (12%) Enterococcus faecal (18.7% are vancomycin-resistant); and 20 (6%) Acinetobacter baumanni (both MDR). Microorganisms among the most popular are 252 (17.8 percent) of patients who were treated in intensive care died. Of the 58 (23%) HAI patients died and 51 (88%) were MDR isolated (p = 0.05) patients.

Conclusion: The production of MDR bacteria is a daunting challenge for clinicians with inadequate treatment possibilities. The risk of developing bacterium MDR-HAI, which has a negative effect on survival, is high for serious cancer patients in intensive care. [*Ethiop. J. Health Dev.* 2021; 35(3): 220-226]

Keywords: Health Care-associated Infections (HAI), ICU, oncology, multi-drug resistant bacteria (MDRB), Antibiotics

Introduction

Health Care-associated Infections (HAI) have, for more than a century, been a significant cause of adverse health effects. HAIs have become a critical concern for high-quality treatment[1, 2]. The emergence of MDRBs has become a public health concern, becoming a crisis. This imposes a new burden on the hospital's health care, especially for patients in the ICU. In addition, the risk of infection rises due to conditions or diseases faced by patients in intensive care with diminished immunity and exposure to multiple intrusive instruments (mechanical ventilation, central venous catheters). CVC) and catheter), respectively[3, 4]. ICU-HAI 's incidence is 5 to 10 times higher than the general department's AHI rating[5]. The goal of the research was to define the prevalence of HAI in the intensive treatment unit oncology and to describe the infectious pathogens' microbiology and antibiotic resistance profile and their MDRB-related mortality effects[6-7]. High risk of nosocomial infection (HAI), including mechanical ventilation, invasive equipment, broad-spectrum antibiotic use, and parenteral feeding, is present in intensive patients in the intensive care unit (ICU). A good antibacterial treatment is very effective for critically ill patients immediately. Care should be reassessed to encourage or increase antibiotic doses once cultural outcomes have been obtained. The cost is optimum, the incidence of over-infection is decreased, and the antibiotic resistance grows minimally[8, 9]. In addition, cancer patients with an elevated risk of HAI, MRB, associated with higher mortality due to a therapeutically failure, are 3-5 times more likely to experience serious sepsis than non-cancer patients [1, 5-7, 10, 11]. Patients with neutropenia or hematological (HM) tumors are more susceptible to this condition relative to patients with solid tumors[12].

Materials and Methods

Mexico City's National Cancer Institute (INCan) is a 125-bedded, adult cancer specialist teaching hospital with an average annual enrollment of 170.000. Every year there are 7,500 launches, 1,400 long-term CVC hospitalizations, 34,000 chemical drug infusions and 3,500 significant surgeries. Efforts were made to improve clinical outcomes for patients admitted to the six-person intensive care unit and the operational intensive care unit, including better patient selection and organized clinical trials.[13]. The mortality trend has, however, increased in recent years with the rise of MDRB-HAI (Table 1). A 5-year retrospective HAI

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descriptive research was performed on the intensive care patients between January 2007 and December 2011. Data was extracted from the extensive daily surveillance reports and modes of infection, laboratory microbiological reports and patient records. Patient symptoms and co-morbidities of all isolates, data on tumor and therapies, microbiology and drug resistance were compiled. The following information was obtained. SOFA: [14] dots are used for ICU intake and infection detection, ICU stay time, days of ventilation, CVC placement days and days of catheter urine. Sequential Organ failure assessment (SOFA) The Centers for Disease Control and Prevention (CDC, 2007) describes HAI in accordance with the guidelines[15]. Blood, urine, tracheal and bronchial secretions, and other suspected site cultures were obtained. To grow bacteria, traditional microbiology methods were used. The BD Phoenix automated device (USA) and Kirby-Bauer disc positioning technologies (Clinical Laboratory Standards Institute, CLSI) have been used to carry out antibiotic susceptibility testing[16]. In the first 24 months, a thorough examination of the patient was done on antibiotic therapy. Antibiotics that are sensitive to the isolated bacteria should be used within a few hours of the clinical infection (if the patient has taken 72 hours)[17]. Infections occurring on more than a single patient site are identified as separate infections unless the same bacteria are isolated at the same time. Prior to discharge or death, an evaluation of the clinical results is performed. According to deaths reported, fatalities are classed as HAI assigned or not connected to infection for the purposes of this investigation. A minimum of two scholars analyzes medical history. Post-Article. MDRB consisted of the following ingredients: Staphylococcus aureus Methicillin-resistant (MRSA), Enterococcus faecalis Vancomycin-resistant (VRE), Escherichia coli and Klebsiella Pseudomonas aeruginosa, Acinetobacter, and other Gram-negative bacteria. Resistance to fluoroquinolones, cephalosporins and carbapenems was observed. 2.1. Chi-square or Fisher exact studies are statistical methods for evaluating qualitative variables. The continuous results are equivalent to the Mann-Whitney U test or the student t-test, according to the data distribution. a confidence interval of 95% (95 % CI) in the likelihood (OR). Statistically important is a P value of 0.05. Calculate use rate of facilities, incident rate for site per cent patients, and frequency per one thousand days, or site density per one thousand patient days. Using Epi-Info (version 7) and STATA (version 12) tools for statistical analysis.

Table 1: **Hospital-acquired infections (HAI), overall mortality, and infection-related mortality in an intensive care unit (ICU)**

Year	2007	2008	2009	2010	2011
HAI rate	7.6	8.5	10.2	9.8	16.9
Patients admitted to the ICU (*n*)	339	299	272	275	250
ICU overall mortality (%)	20	17	16	19	17
HAI mortality (%)	20	30	32	27	51
ICU stay, days, median (IQR)	4 (2–4)	2 (1–4)	2 (1–6)	3 (1–6)	4 (2–5)
Infection rate by site					
VAP	3.5	4.2	4.5	3.9	9.3
VAP/1000 ventilator-days	1.9	16.2	15.1	11.9	30.9
CA-UTI	3	2	3.7	3.9	2.4
CA-UTI/1000 catheter-day	5	3.4	6.1	6.6	3.2
CLABSI	0.7	0	0.5	0	0.7
SSI	0.4	1.2	1.5	1.3	1.9
Abdominal sepsis	0.8	1.1	1.4	1.8	2.1
Prevalence (%) MDR-HAI pathogens	33.5	37.3	30.4	35.3	62.1

Results

During the time under consideration, 1.418 patients were admitted to the critical care unit.134 patients had 159 AIH cases (110 had 1 case, 23 had 2 cases, 1 with three AIH cases). In addition, 11.2/100 patients and 32.2/100 patients in the intensive care department were HAI (Table 1). The patients' average age was 50 years, with 65 (48.4%) participants. Septic shock (43%), hypovolemic shock (25%), respiratory dysfunction (15%) and post-operative treatment (10%) are the most common reasons for the ICU. Other population and clinical features can be found in Table 2. 72 (45.3 percent) cases have had VAP, 41 (25.8 percent) have had catheter urinary tract (CA-UTI), 21 surgical sites (SSI) cases have been 13.2 %, 20 (12.6 percent) and 5 (3.1 percent) have a CLABSI (catholyte-infection). The catheterization index for CA-UTI is 17.1/1000 days. The average ventilation time of the VAP is 8.2/1000 days. The mechanical ventilation number of days is estimated at about 14,4 and 10,2 days in VAP patients. Culturally confirmed were 145 (91.2 percent) and clinically, 14 (8.8 percent) were culture-negative infections. 266 species have been isolated from microorganisms, of which 105 were MDR; overall prevalence was 39,5%. The bacteria have been distributed as follows: 148 grammes negative (55.6%), 86 grammes positive (32.3%) and 32 grammes yeast (12.1%). Escherichia coli (n = 54%; 94.4% produces ESBL), Staphylococcus aureus (n = 32, 12%; 90% produces MRSA), Enterococcus faecalis (n = 32%, 12%); 18.7% produces VRE; Pseudomonas aeruginosa (n = 29%, 11%; MDRs 14%) and Acinetobacter baumannii (n = 15%) produce six percent (TDR) (TDRs). All organisms most common are Escherichia coli (n = 54.20%; In the intensive care unit, MDRB-HAI patients spend more days than HAI-susceptible patients (16-6 days, p = 0.02). (12 days). In patients with PAV (p = 0.03) or bacteremia (p = 0.03), MDRB is more often isolated. 75 patients (56%) began adequate clinical antimicrobial therapies, but deaths

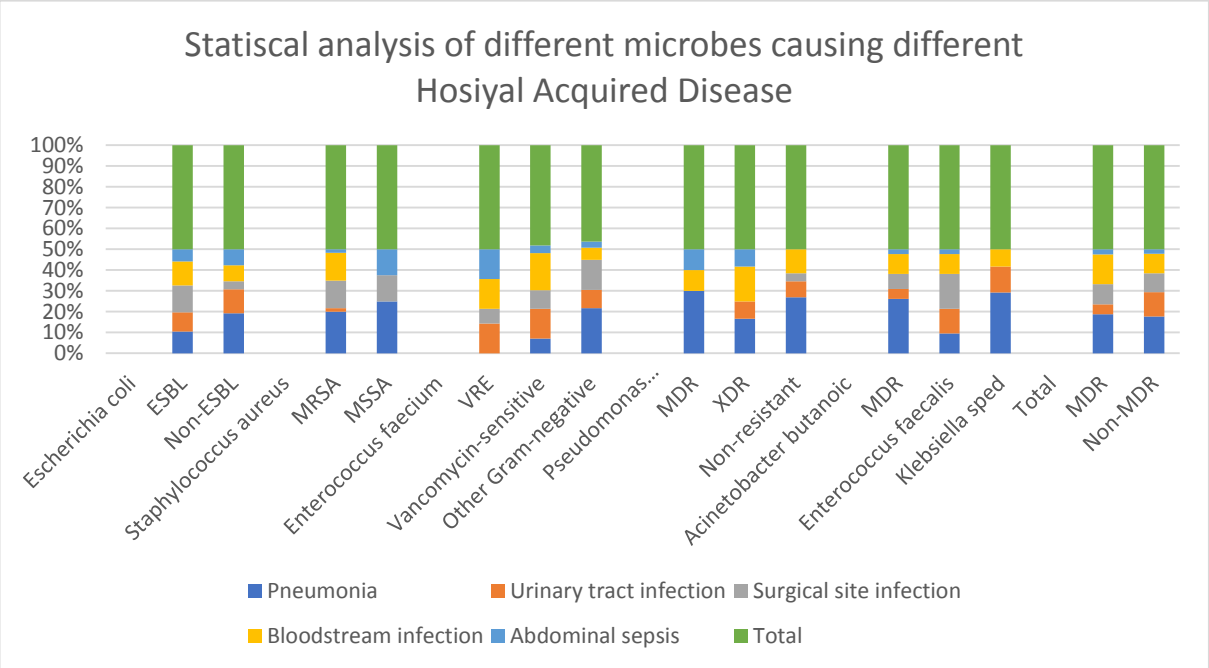
were not affected even under MDRB (p = 0.8) (p= 0.9). The SOFA admission score for the intensive care unit varied between 8.4 and 3.3, and the SOA score for HAI was 7.4 to 4.1 (p=0.03). There were no statistically significant differences in patients with the condition regardless of development. MDRB-HAI (7.1 3.5 and 7.4 4.1, respectively, with p = 0.5) has not yet been developed. In patients with hematological tumors, even among MDRB patients, there was no difference between death rate (p=0.7). 252 (17.8 percent) of those patients (n=1.418) enrolled in the ICU died. The number of patients with HAI is 58 (23 percent), and the MDRB isolated is 51 (88 %). The MDRB-HAI mortality rate was significantly higher than the MDRB-HAI (p = 0.05) mortality rate. A five-month MDR A in 2011. The intensive care unit baumanni outbreak occurred. The disease was removed from the skin, urine, and tissue of 13 of those patients, one of whom had an infection of the surgical site; it was only removed from blood cultures in two of these cases. Eleven (73%) patients have died, and the HAI death rate has risen to 53%.

Table 2: **Demographic and clinical characteristics in the intensive care unit (ICU) patients with hospital-acquired infections (HAI) (2007–2011)**

Characteristic, n (%)	Patients (N = 134)
Age, years, median (range)	4 9 (16–93)
Male	66(48.5%)
Underlying oncological disease	
Genitourinary	31 (23.9)
Lymphoma	17 (11.9)
Acute leukemia	12 (10.4)
Esophagus and stomach	12 (7.5)
Colon and rectum	8 (6.7)
Breast	7 (4.5)
Status of cancer at ICU admission	
Recent diagnosis	80 (64)
Progression	14 (8.5)
Complete remission	14 (12.3)
Recurrence	14 (9.2)
Non-response	7 (6.1)
ICU admission diagnosis	
Septic shock	59 (43)
Hypovolemic shock	30 (25)
Respiratory failure	23 (14.9)
Post-operative surgical care	15 (10.4)
Other reasons	7 (4.4)
Chemotherapy within 2 months	24 (19.4)
Mechanical ventilation	133 (97.8)
Co-morbidities	
Diabetesmellitus	12(10.4)
Chronicrenal failure	8(4.5)
Others	8(5.2)

Table 3: **Most frequent microorganisms isolated in an intensive care unit (ICU) patient with hospital-acquired infections (HAI) (2007–2011)**

Microorganisms	Pneumonia	Urinary tract infection	Surgical site infection	Bloodstream infection	Abdominal sepsis	Total
Escherichia coli						
ESBL	9	8	11	10	5	43
Non-ESBL	5	3	1	2	2	13
Staphylococcus aureus						
MRSA	12	1	8	8	1	30
MSSA	2	0	1	0	1	4
Enterococcus faecium						
VRE	0	2	1	2	2	7
Vancomycin-sensitive	4	8	5	10	2	27
Other Gram-negative	15	6	10	4	2	32
Pseudomonas aeruginosa						
MDR	3	0	0	1	1	5
XDR	2	1	0	2	1	6
Non-resistant	14	4	2	6	0	26
Acinetobacter butanoic						
MDR	11	2	3	4	1	21
Enterococcus faecalis	4	5	7	4	1	21
Klebsiella sped	7	3	0	2	0	12
Total						
MDR	39	10	20	30	5	104
Non-MDR	49	32	25	26	6	138



The graph provides us with information regarding the capacity of different gram positive and gram-negative bacteria to affect patients in hospital leading to acquired diseases from hospital.

From the graph it can be concluded that the following pathogen is responsible most for the respective hospital acquired cancer diseases: -

- MDR- Pneumonia
- VRE- Urinary tract infection
- XDR- bloodstream of infection
- Enterococcus faecalis- Surgical Site infection
- VRE- Abdominal Sepsis

Discussion

Cancer is one of the world's leading deaths, comprising of 13% of all deaths in 2008[18]. They are targeted, higher recovery and remediation rate. In-hospital treatment cancer patients entering the intensive care unit gradually appear[19-22]. The HAI values of the intensive care unit are higher than the general hospital ward because of the complex interaction between patients. Specific conditions, co-morbidity, disease incidence, type of intensive care unit, the period of stay and the use of multiple intrusive procedures by patients[23]. The mechanical ventilation and the failure of 2 or more organs were independent of each other in the studied hematological malignancies in the intensive care unit—hospital-related deaths. The death rates in intensive care units, hospitals over six months were respectively 34%, 46%, over 59%[20]. Further analysis showed a negative effect on the mortality of cancer patients with respiratory failure, growth, and production. In the intensive care unit, patients with septic shock remain[21]. The overall mortality rate for 6 years of follow-up for the previous study at our center was 18% (302 deaths/1,670 patients), but no co-morbidity data was available[6]. Death is recorded in the report. 23% are correlated with HAI in 18% of all cases. In 2011, NAV increased dramatically compared to the Acinetobacter epidemic when considering the rate of infection per area. The incidence of MDR-HAI pathogens was considerably higher the same year. There were no major improvements in the rates of infection in the review of the remainder of the sample (2007-2010). Please note that the CLABSI score is still below 1 due to the strict administration of the vascular midline at our hospital. Many factors, including pre-treatment, cross-transmission and hospital stay period, are related to the risk of MDRB infection[24]. Intensive treatment was added to the hospital for patients with serious cancer. There is a high risk of ICU infection with MDRB, which has a detrimental effect on mortality[25, 26].

Futile and unsuccessful attempts to cure and prevent cancer

MDRB has been discovered in 88 percent of our patients, indicating a relationship between multi-drug-resistant bacteria and a significant risk of death, since those who acquired HAI have passed away. The risk of mortality of MDRB-HAI patients is 20 times higher, even with adequate care than in other patients with non-cancer. The patients suffered from low blood count, which is since their RBC is undergoing apoptosis or formation of RBC in bone marrow is occurring at a slower rate than normal. This symbolizes that the patient is suffering provably from bone marrow related anemia, or it may be that tumor suppressing genes which are responsible for cancer are acting on the RBC and due to such malfunction, the RBC count or the blood count becomes low. We find that MDRB patients had a higher mortality rate, consistent with another research.

-Does antimicrobial treatment HAI receive adequate?

The morbidity and organ failure of ICU patients, which are separate mortality factors, are responsible for these findings. In the previous study from our institution on E patients. Hepatitis of coli ESBL and bacteremia is double the mortality rate of non-ESBL12 E patients.

Bacteria with bacteria

The proportion of drug-resistant bacteria isolates in our intensive care department represents the widespread and increasing drug-resistant trend issue in all types of hospitals. The bacteria have become a new pathogen in the hospital, especially for intensive treatment and are often related to epidemics, most commonly NAV[27-29]. This is generally because the equipment and materials have been infected[30-32]. However, none of them were associated with high mortality, or lengthy hospital stays in the evaluation of other drug-resistant microorganisms. The calculation is not reliable due to the limited number of these isolates.

Conclusion

Our organization is committed to improving the management and monitoring of antibiotics. These steps, including minimizing antibacterial medication in intensive care facilities, consolation with experts on infectious diseases, restricting treatment and maximizing the dose of antibacterial medicine, have been improved since 2011. These initiatives include the advent of MDRB led to physicians being questioned, i.e. not having adequate care options. The risk of MDRB-HAI is high in severe patients undergoing cancer in the intensive care unit. It also has a detrimental effect on mortality despite the immense efforts and costs.

Glossary

HAI-Nosocomial infection is basically a hospital acquired infection.

Neutropenia-Neutropenia is when a person has a low level of neutrophils

MRDB- when a single bacterium is resistant to more than one antibiotic is commonly called Multidrug-resistant bacteria (MRDB).

Haematological malignanancy - Hematologic malignancies are cancers that affect the blood, bone marrow, and lymph nodes.

CLABSI - A central line-associated bloodstream infection (CLABSI) is a serious infection that occurs when germs (usually bacteria or viruses) enter the bloodstream through the central line.

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