ELECTROLYTES IMBALANCE AMONG PATIENTS WITH ONCOLOGIC EMERGENCIES AT A UNIVERSITY HOSPITAL

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International Academic Journal of Health, Medicine and Nursing (IAJHMN) | ISSN 2523-5508

Received: 15th June 2019

Accepted: 24th June 2019

Full Length Research

Available Online at:

http://www.iajournals.org/articles/iajhmn_v1_i2_58_83.pdf

Citation: Abdel-Aziz, E. Z., Elfeky, H. A. A. & AboSeda, A. I. (2019). Electrolytes imbalance among patients with oncologic emergencies at a university hospital. *International Academic Journal of Health, Medicine and Nursing, 1*(2), 58-83

ABSTRACT

Background: Oncologic emergencies are life-threatening disorders. They represent an important reason for ICU admission as a result of malignancy-specific electrolyte disorders. Thus, their recognition and treatment are necessary. **Aim of the study:** To identify types, predisposing factors and manifestations of electrolyte imbalances among adult critically ill patients with oncologic emergencies at one of the university Hospitals - Egypt. Research design: A descriptive research design was followed in this study. Sample: A purposive sample consisting of 100 patients was included. Tools of data collection: Patient's demographic and medical data sheet; Fluid and electrolyte monitoring data sheet, and Oncologic emergency patients' assessment sheet. Results: The great majority (93%) of the studied sample received chemotherapy. Nearly half (45%) of patients were admitted to the ICU with neutropenic fever. Hyponatremia, hypokalemia, and hypocalcemia were the most common electrolyte imbalances on admission to the ICU in percentage of 71%, 50%, and 49% respectively. The most common causes of electrolyte alterations were gastrointestinal problems (anorexia to food, anorexia to fluids, vomiting, diarrhea, and difficult in swallowing) in percentage of 77%, 69%, 52%, 41%, and 40% respectively. Disorientation / confusion was associated with hyponatremia (in percentage of 91.5%, 84.4%, and 75.5% respectively) and hypocalcemia ((in percentage of 85.7%, 83.3%, and 94.1% respectively); Nausea and slurred speech were associated with hypokalemia in percentages of 70% and 50%; 61.1% and 38.7%; and 61.5% and 39% respectively. **Conclusion:** the studied patients had many risk factors that altered their recovery and so, their prognosis. **Recommendations:** Continuous assessment and monitoring for patients undergoing chemotherapy; early detection and prevention of oncological emergencies; provision of lifesaving and immediate interventions to prevent further deteriorations; Establishment of rehabilitation programs for prevention of/ minimizing oncologic emergencies; and provision with written instructional guidelines about side effects of chemotherapy and when to seek medical interventions.

Key Words: *assessment, electrolytes imbalances, management, oncologic emergencies*

INTRODUCTION

Disturbance in fluid and electrolytes are among the most common clinical problems encountered by critically ill cancer patients. It can lead to life threatening complications which is known as oncologic emergencies. They represent an important reason for admission to the ICU and can negatively affect patients' prognosis (Behl, Hendrickson & Moynihan, 2010).

Oncologic emergencies are clinical conditions resulting from metabolic, neurologic, cardiovascular, hematologic, and infectious changes caused by cancer or its treatment. When these malignancy-specific electrolyte disorders are manifested, they can lead to life threatening complications that required emergent therapy. They require observation, accurate

judgment, immediate intervention to prevent alteration in quality of life and / or death. However, delay in diagnosis and treatment can result in unfavorable outcomes, increased ICU length of stay and increased hospital costs (Das, Lakshmaiah, Suresh & Bahu, 2015).

According to the Oncology Nursing Society (ONS) (2010), oncologic emergencies can be classified as neurologic emergencies (e.g. spinal cord compression, increased intra cranial pressure); infectious emergencies which involve neutropenic fever, and septic shock; and metabolic emergencies (e.g. hypercalcemia, tumor lysis syndrome, and syndrome of inappropriate anti diuretic hormone secretion). Signs and symptoms of oncologic emergencies may occur at any time from diagnosis to the end-stage of malignancy (Pi et al., 2016). Hypercalcemia, hypomagnesemia, hypokalemia, hyponatremia and hypocalcemia may develop as a result of anticancer drugs (Liamis, Filippatos & Elisaf, 2016).

Patients with oncologic emergencies may have several symptoms ranging from mild cognitive deficit to severe neurologic symptoms. Rapid change in electrolytes can cause permanent neurological impairment. In many cases, electrolyte imbalances may result in nausea, vomiting and consequently, dehydration and acid base imbalances (Khan, Dellinger & Waguespack, 2018). Thus, recognition and treatment of these disorders is necessary, and delay in diagnosis can cause unfavorable outcomes.

SIGNIFICANCE OF THE STUDY

Throughout clinical experience, critically ill cancer patients were noticed to have many life-threatening health problems that require immediate admission to the ICU, of these are dehydration, fluid over load, hypertension, and pulmonary edema. As well, revision of ICU medical records of the Oncology Center- Mansoura University (OCMU) in 2017 revealed that nearly 20 patients are admitted monthly to the ICU with oncologic emergencies, and they presented approximately half of patients admitted to the ICU. This represents a challenge for all medical staff as they struggle to save patients' life.

Therefore, it is crucial to have assessment data about frequency, types of electrolyte disorders, and clinical symptoms associated with electrolyte imbalances among this category of patients. This can help in having data base regarding this problem, and taking corrective actions that can minimize complications and improve patients'` outcomes. Thus, the present study was conducted to provide data about types, predisposing factors, and manifestations of electrolyte imbalances among patients with oncologic emergencies at Oncology Center-Mansoura University (OCMU).

SUBJECTS AND METHOD

Aim of the Study

The aim of this study is to identify types, predisposing factors, and manifestations of electrolyte imbalances among adult critically ill patients with oncologic emergencies at oncology center – Mansoura University.

Research Questions

1. What are types of electrolyte imbalances among patients with oncologic emergencies at oncology center - Mansoura University?
2. What are signs and symptoms associated with electrolyte imbalances among patients with oncologic emergencies at oncology center - Mansoura University?
3. What are factors predisposing to electrolyte imbalances among patients with oncologic emergencies at oncology center - Mansoura University?

Research Design

A descriptive research design was utilized in the current study. It is used to explain a phenomenon of interest and give attention to one category or population characteristics, qualities, and /or expertise (Polit & Beck, 2008; and Schemidt & Brown, 2014). The current research used this type of research design because involved subjects were observed without any manipulation by the researcher.

Setting

This study was conducted at one of the intensive care units (medical intensive care unit) affiliated to an oncology center –Mansoura University. It is equipped to provide care for critically ill oncology patients. It consists of six beds, and contains mechanical ventilators, cardiac monitors, ECG machine, two non-invasive CPAP and infusion pumps. The flow rate of patients with oncologic emergency to the ICU is nearly 20 patient/ month, according to ICU medical records of the Oncology Center- Mansoura University (OCMU) in 2017.

Subjects

A purposive sample consisting of 100 patients who admitted to ICU over a period of 6 months was included in this study based on the following inclusion criteria: adult cancer patients (aged from 18 to 60 years old), of both sexes, undergoing chemotherapy, have oncologic emergencies and willing to participate in the study. Patients receiving medications that affect serum laboratory values and those who stay less than 24 hours in ICU were excluded from the study.

Tools of Data Collection

Three tools were utilized to collect data pertinent to the current study. Two tools (patients' demographic and medical data sheet, and fluid and electrolyte monitoring data sheet) were developed by the investigators after reviewing the related literature and in the light of Hinkle, & Cheever, (2014); Metheny, (2012); and Grossman, & Porth, (2014). The third tool (oncologic emergency patients' assessment sheet) was adopted from Diab, (2003), and modified by the investigators.

Tool I - Patients' demographic and medical data sheet: This tool consists of two parts: Patients' demographic data (patient's age, gender, level of education, occupation, date of admission, and length of ICU stay); and medical data (current diagnosis, past medical history,

smoking habits, body mass index, type of anticancer treatment and its related complications, diet regimen, and patients' prognosis.

Tool II - Fluid and Electrolyte Status Monitoring Data Sheet: This tool was developed to monitor fluid and electrolyte status and identify predisposing factors to alteration. It covers data related to serum electrolyte values (serum sodium, potassium, calcium, magnesium, and phosphorus) and interpretation of findings; arterial blood gases (values of PH, HCO3, PaO2, and PaCo2); hemodynamic variables (body temperature, blood pressure, and central venous pressure); and predisposing factors to electrolytes imbalance such as presence, frequency and duration of vomiting, diarrhea, anorexia to food or fluids and difficulty in swallowing food or fluids; presence of fistulas, colostomy, ileostomy and type and amount of output; fluid balance status, and provision of hydration therapy.

Tool III - Oncologic Emergency Patients' Assessment Sheet: This tool was developed to assess patients for manifestations of fluid and electrolyte imbalance by assessing body systems: Cardiovascular system was assessed by checking pulse, ECG changes related to electrolyte imbalances, and observing jugular veins distention; Respiratory system was assessed based on respiratory rate, depth, presence of dyspnea, crackles, and wheezes; Nervous system was assessed by checking for neurological status alterations (disorientation, confusion, decreased attention, decreased memory span, hallucination, increased reflexes, drowsiness, numbness, seizers, and coma); Gastrointestinal system was assessed by checking for presence of GIT disturbances as vomiting, nausea, diarrhea, constipation, abdominal colic, cramps, bowel sounds / motility, and presence of ascites, Renal system was assessed by documenting urine output, and presence of edema; this in addition to assessing skin (turgor, temperature, and moisture), eyes by assessing the conjunctiva, and the oral cavity by checking mucus membrane, lips, tongue and viscosity of saliva.

Validity and Reliability of the Data Collection Tools

Developed tools were tested for content validity by a panel of five experts. Two experts from Anesthesia and Intensive Care Department, Faculty of Medicine, Mansoura university and three experts from Critical Care and Emergency Nursing Department, Faculty of Nursing, Cairo and Mansoura university who reviewed the tools for clarity, relevance to the aim of the study, and the applicability. Internal consistency and reliability of the data collection tools were assessed via Cronbach`s Alpha which revealed that r = 0, 81 for fluid and electrolyte monitoring data sheet (tool II) and r = 0, 78 for oncologic emergency patients` assessment sheet (tool III).

Pilot Study

A pilot study was carried out on 10 patients (10% of the total sample) to test feasibility, and applicability of the data collection tools. Carrying out the pilot study gave the investigators experience to deal with the included subjects and use the data collection tools. The necessary modifications and adjustments were done based on results of the pilot study. Subjects involved in the pilot study were excluded from the main study.

Protection of Human Rights

An official permission to conduct the study was obtained from the research Ethical Committee - Faculty of Nursing Mansoura University. Also, an official agreement to conduct the study was obtained from the hospital administrative authority after explanation the aim and nature of the study. Informed consents were obtained from conscious patients or from their responsible caring persons (if patients were unconscious). Voluntary participation and the right to refuse to participate in the study were emphasized. Anonymity and confidentiality of involved subjects were assured through coding of all data. Subjects were assured that these data will not be reused in another research without their permission.

Procedure

The current study was started since December 2016 with preparation of different data collection tools after reviewing the related literatures, web sites and seeking experts` advices. Data collection tools were developed and tested for content validity and reliability. Then official agreements to carry out the study were obtained from directors of the oncology center and the intensive care unit. Once permissions to carry out the study were granted, the actual data collection was started from March 2017 to September 2017. Informed consents were obtained from conscious patients who met the inclusion criteria or from their responsible caregivers on admission to the ICU after explaining the aim and benefits of the study. Then the investigators started actual data collection, by assessing patients for three different times.

The first assessment was on admission to the ICU, where the investigators obtained patients' data from the medical records using tool (I). Then the investigators gathered data regarding factors predisposing to electrolyte imbalances such as receiving hydration therapy, body fluid status, GIT symptoms, laboratory values such as serum electrolytes levels and arterial blood gases, in addition to hemodynamic variables. These data were obtained using tool (II) "based on Ibn Sina Hospital Management System" (the largest medical record that contain all data about patients at Mansoura University Hospitals). This assessment required about 20-30 minutes to be completed for each patient.

Then the investigators examined patients for manifestations of electrolyte disturbances using tool (III). The investigators started assessment by communicating with involved patients to assess level of consciousness, their ability to speak and behavioral changes by asking the patients to confirm their names, date of birth, the place where they are, and the current events. Then the investigators inspected patients' skin for any abnormalities in eyes, eye lids, conjunctiva, lips, mucus membrane, tongue, neck for jugular vein distention by placing the patient in supine position at a 45-degree angle and turn the head to the side and note any enlargement of the jugular vein, and extremities. Then the investigators auscultated heart, lungs and bowel sounds. Palpation of skin temperature, joints, abdomen, muscle strength. This head-to-toe assessment required about 30 minutes for each time and for each patient. The investigators repeated the assessment for another two times using tool II, III.

The second assessment was after patients' stabilization, and the third assessment was carried out after receiving medical treatment or before discharge where the investigators repeated the same data collection procedure as in the first assessment.

RESULTS

Table 1 illustrates that, more than three quarters (77%) of the studied sample were in the age group ranged between 46-60 years old, with a mean age of 51.19 ± SD=12.19; 65% of patients were females, nearly half had leukemia, and hematologic cancer, in percentages of 46% and 49% respectively. As regards ICU stay, around half (47%) stayed from 2-4 days, with a mean ICU stay of 4.88 ±SD=1.86 days. Figure 1 shows that nearly half (45%) of the studied sample were admitted to the ICU with neutropenic fever and one quarter (25%) had tumor lysis syndrome (TLS). Table 2 shows that, the most common hemodynamic alterations among the studied sample on admission were hyperthermia, tachycardia, hypotension, and hypovolemia in percentages of 58%, 52%, 40%, and 36% respectively. Hyperthermia and hypotension were commonly noticed in the second assessment in percentages of 50% and 40% respectively. However, normal findings were noticed in the third assessment time regarding body temperature, pulse, blood pressure (BP), and central venous pressure (CVP) values, in percentages of 61%, 59%, 40%, and 50% respectively. No significant statistical differences were noticed in hemodynamic variables in different assessment times except when comparing the first and 3rd assessment regarding body temperature, pulse, and CVP ($\chi 2$=10.15, 9.96, and 8.70 at $p \leq 0.006$, 0.007, and 0.013 respectively).

Table 1: Frequency Distribution of the Studied Sample according to Demographic and Medical Characteristics (N=100)

Characters	No	%
Age		
- 18-25	6	6.0
- 26-45	17	17.0
- 46-60	77	77.0
Age Range: 19 - 60 years, Mean ±SD: 51.19±12.19		
Gender		
- Males	35	35.0
- Females	65	65.0
Diagnosis		
- Digestive Neoplasms	19	19.0
- Respiratory Neoplasms	10	10.0
- Breast cancer	18	18.0
- Endocrinal Neoplasms	2	2.0
- Urinary Neoplasm	2	2.0
- Leukemia and hematologic cancer	49	49.0
Past medical history		
- No past history	34	34.0
- Cardiac disease	14	14.0
- Renal disease	5	5.0
- Neurologic disease	1	1.0
- Endocrinal disease	18	18.0
- Metastasis	5	5.0
- D.M. and Cardiac	5	5.0
- D.M. and Hypertension	18	18.0
Length of stay in ICU(Days)		

- 2-4 days	47	47.0
- 5-6 days	29	29.0
- 7-10 days	24	24.0
Range = 2-10 days, Mean ± SD= 4.88 ±1.86 days		

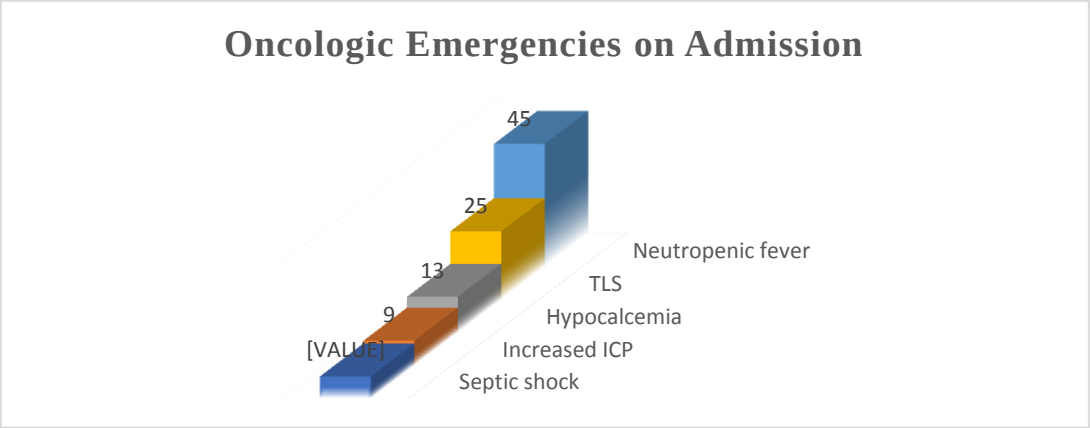


Figure 1: Percentage Distribution of the Studied Sample as regards Oncologic Emergencies on Admission to ICU (N=100)

Table 2: Frequency Distribution of Studied Sample in Relation to Hemodynamic Monitoring in Different Assessment Times (N=100)

Hemodynamic variables / Assessment times, N & %		Assessment Times On Admission	2nd Assessment	3rd Assessment	Sign. Test
Temp.	Normal	42	47	61	
	Hyperthermia	58	50	37	
	Hypothermia	0	3	2	χ^2=3.96
	Test of significance		χ^2=3.87, $P_1 \leq 0.144$ NS	χ^2=10.15, $P_2 \leq 0.006$*	$P_3 \leq 0.14$ NS
Pulse	Normal	44	53	59	
	Tachycardia	52	43	35	χ^2=1.54
	Bradycardia	4	4	6	$P_3 \leq 0.46$
	Test of significance		χ^2=4.00, $P_1 \leq 0.135$ NS	χ^2=9.96, $P_2 \leq 0.007$*	NS
BP	Normal	34	32	40	
	Hypertension	26	28	26	χ^2=1.45
	Hypotension	40	40	34	$P_3 \leq 0.48$
	Test of significance		χ^2=0.13, $P_1 \leq 0.935$ NS	χ^2=0.97, $P_2 \leq 0.615$ NS	NS
C.V.P. reading (N=80)	Normal	32 (40%)	43 (53.75%)	50 (62.5%)	
	Above	12 (15%)	11 (13.75%)	10 (12.5%)	χ^2=1.36
	Below	36 (45%)	26 (32.5%)	20 (25%)	$P_3 \leq 0.51$
Test of significance			χ^2=3.27, $P_1 \leq 0.195$ NS	χ^2=8.70, $P_2 \leq 0.013$*	NS

***:** Significant at $p \leq 0.05$ NS: No significant statistical difference.

P_1: comparison between on admission vs. 2nd assessment**, P_2:** comparison between on admission vs. 3rd assessment, **P_3:** comparison between 2nd assessment vs. 3rd assessment.

Figure 2 shows that, the most common electrolyte imbalances among the studied sample on admission to the ICU were: hyponatremia, hypokalemia, and hypocalcemia in percentage of 71%, 50%, and 49% respectively. Decline in the percentages of patients who had hyponatremia, (71%, 58%, 45%), hypokalemia (50%, 49%, 39%), and hypocalcemia (49%, 48%, 34%) were noticed in the second and third assessment as compared to the first assessment time, with no significant statistical differences, except when comparing the admission versus the 3rd assessment (χ^2=13.54, $P_2 \leq 0.001$, and χ^2=9.02, $P_2 \leq 0.011$) respectively regarding hyponatremia, and hypocalcemia; the 2nd assessment versus the 3rd assessment ($\chi^2 = 7.35$, $p3 \leq 0.025$) regarding hypocalcemia.

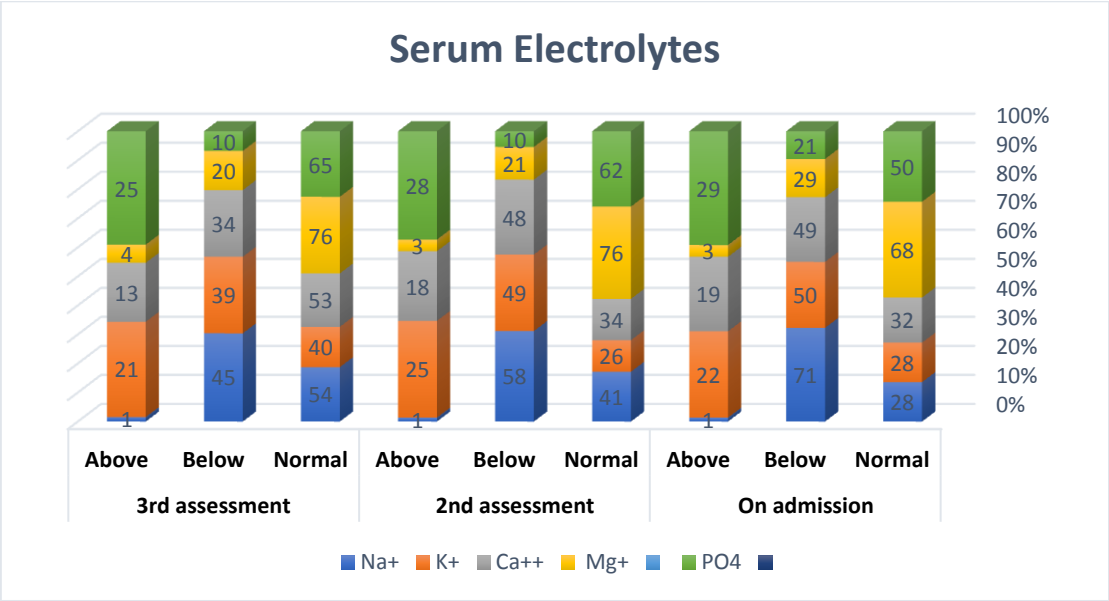


Figure 2: Serum Electrolytes Variation among the Studied Sample Different Assessment Times (N=100)

Table 3 shows that, the most common manifestations of hyperkalemia were GIT problems (nausea, vomiting, and abdominal cramps) in the three assessment times, in percentage of "100%, 95.4%, and 59%,", "84%, 76%, and 52%", and "90.4%, 80.9%, and 75.1%" respectively. The percentage of patients who experienced abdominal cramps increased in the third assessment time as compared to first and second assessment times, with a significant statistical difference (χ^2 =13.8 / $p \leq 0.001$).

The most common symptoms associated with hypokalemia in different assessment times were GIT manifestations (nausea) in percentage of 70%, 61.2%, and 61.5% respectively; slurred speech in percentage of 50%, 38.7%, and 39% respectively, with no significant statistical difference.

Table 3: Frequency Distribution of the Studied Sample according to Signs and Symptoms of Hyper and Hypokalemia in Different Assessment Times

Electrolyte disturbances	Manifestations on body systems	First Assessment N. 22	%	2nd assessment N. 25	%	3rd assessment N. 21	%	χ^2	P. value
Hyperkalemia	**GIT**								
	-Nausea	22	100	21	84.0	19	90.4	**3.74**	**0.154 NS**
	-Vomiting	21	95.4	19	76.0	17	80.9	**3.45**	**0.178 NS**
	-Intestinal colic	4	18.1	3	12.0	4	19.0	**0.51**	**0.773 NS**
	-Abdominal Cramps	13	59.0	13	52.0	21	75.1	**13.8**	**0.001****
	Renal								
	-Oliguria	10	45.4	8	32.0	8	38.0	**0.98**	**0.638 NS**
	ECG								
	-Widened QRS	7	31.8	6	24.0	5	23.8	**0.48**	**0.787 NS**
	-Absent P wave	3	13.6	3	12.0	3	14.2	**0.06**	**0.972 NS**
	-Tall, peak T wave	3	13.6	3	12.0	3	14.2	**0.06**	**0. 47 NS**
Manifestations on body systems		**N. 50**	**%**	**N. 49**	**%**	**N. 39**	**%**	χ^2	**P. value**
Hypokalemia	**GIT**								
	-Absent bowel sound	4	8.0	3	6.1	2	5.1	**0.32**	0.854 **NS**
	-Decreased motility	17	34.0	16	32.6	12	30.7	**0.10**	0.949 **NS**
	-Anorexia	31	62.0	23	46.9	22	56.4	**2.31**	0.315 **NS**
	-Nausea	35	70.0	30	61.1	24	61.5	**1.04**	0.594 **NS**
	-Vomiting	24	48.0	21	42.8	13	33.3	**1.96**	0.376 **NS**
	Speech changes								
	-Slurred speech	25	50.0	19	38.7	10	39	**5.46**	0.065 **NS**
	-Tendency to irrelevance	12	24.0	8	16.3	6	15.3	**1.38**	0.502 **NS**
	ECG changes								
	-ST segment depression	11	22.0	6	12.2	6	15.3	**1.76**	0.414 **NS**
	-Elevated U wave	1	2.0	1	2.0	1	2.5	**0.04**	0.981 **NS**

Responses are not mutually exclusive. **NS**: No significant difference ** Significant at p≤0.001

Table 4 shows that, the most common symptoms associated with hyponatremia in the three assessment times were GIT problems (anorexia) in percentage of 43.6%, 58.6%, and 53.3% respectively; neurologic manifestations (disorientation or confusion) in percentage of 91.5%, 84.4%, and 75.5% respectively; dry mucus membranes in percentage of 54.9%, 56.8% and 64.4% respectively. Significant statistical differences were found in the percentages of patients who had vomiting and coma as at three assessment times (p≤0.041, and p≤0.003) respectively.

Table 4: Frequency Distribution of the Studied Sample as Regards Signs and Symptoms of Hyponatremia in Different Assessment Times

Electrolyte disturbances	Manifestations on body systems	First assessment		2nd assessment		3rd assessment		χ^2	P. value
		N. 71	%	N. 58	%	N. 45	%		
Hyponatremia	**GIT**								
	-Anorexia.	31	43.6	34	58.6	24	53.3	**2.97**	0.226 **NS**
	-Nausea.	20	28.1	20	34.4	22	48.8	**5.21**	0.074 **NS**
	-Vomiting.	20	28.1	20	34.4	23	51.1	**6.39**	0.041*
	Renal system								
	-Oliguria.	20	28.1	16	27.5	16	25.5	**0.94**	0.626 **NS**
	Nervous system								
	-Disorientation	65	91.5	49	84.4	34	75.5	**5.57**	0.062
	-Lethargy.	18	25.3	15	25.8	13	28.8	**0.19**	0.908 **NS**
	-Hallucination.	36	50.7	28	48.2	23	51.1	**0.11**	0.945 **NS**
	-Seizers.	13	18.3	10	17.2	8	17.7	**0.02**	0.988 **NS**
	-Coma.	0	0	0	0	4	8.8	**11.74**	0.003*
	Mouth								
	-Dry m. membrane.	39	54.9	33	56.8	29	64.4	**1.07**	0.58 **NS**
	-Dry, cracked lips.	26	36.6	22	37.9	20	44.4	**0.76**	0.685 **NS**
	-Increased saliva viscosity.	2	2.8	1	1.7	1	2.2	**0.17**	0.918 **NS**

Responses are not mutually exclusive.

***:** Significant at p≤ 0.05 **NS**: No significant difference

Table 5 shows that the most common GIT manifestations associated with hypercalcemia in different assessment times were nausea and constipation in percentage of 73.6%, 77.7%, and 84.6% respectively. Lethargy was the most common neurological manifestation in percentage of 63.1%, 72.2%, and 84.6% respectively. Signs and symptoms of hypercalcemia didn't differ significantly in the three assessment times. As regards hypocalcemia, it was most commonly associated with neurologic manifestations such as disorientation / confusion in percentage of 85.7%, 83.3%, and 94.1% respectively. No significance statistical differences were found in signs and symptoms of hypocalcemia at the three assessment times.

Table 5: Frequency Distribution of the Studied Sample according to Signs and Symptoms of Hyper and Hypocalcemia in Different Assessment Times

Electrolyte disturbanc	Manifestations on body systems	First assessment N. 19	%	2nd assessment N. 18	%	3rd assessment N. 13	%	χ^2	P. value
Hypercalcemia	**GIT**								
	-Nausea	14	73.6	14	77.7	11	84.6	**0.54**	0.764
	-Vomiting	13	68.4	13	72.2	11	84.6	**1.10**	**NS**
	-Constipation	14	73.6	14	77.7	11	84.6	**0.54**	0.577
									NS
									0.764
									NS
	Renal system								
	-Polyurea	6	31.5	4	22.2	3	23	**0.50**	0.779
									NS
	Nervous system								
	-Disorientation/	8	42.1	10	55.5	9	69.2	**2.31**	0.314
	confusion	1	5.2	1	5.5	0	0.0	**0.73**	**NS**
	-Decrease memory span	7	36.1	6	33.3	3	23	**0.70**	0.693
	-Decrease attention	12	63.1	13	72.2	11	84.6	**1.76**	**NS**
	-Lethargy								0.706
									NS
									0.414
									NS
	ECG changes								
	-Shortened QT interval	8	42.1	6	33.3	6	46.1	**0.57**	0.751
									NS
Manifestations on body systems		**N. 49**	**%**	**N. 48**	**%**	**N. 34**	**%**	χ^2	**P. value**
Hypocalcemia	**Nervous system**								
	-Disorientation /	42	85.7	40	83.3	32	94.1	**2.17**	0.338
	confusion	7	14.2	6	12.5	4	11.7	**0.13**	**NS**
	-Numbness	9	18.3	8	16.6	8	23.5	**0.63**	0.938
	-Tingling of fingers and	23	46	19	39.5	15	44.1	**0.54**	**NS**
	toes								0.729
	-Seizures								**NS**
									0.763
									NS
	ECG changes								
			6.12	3	6.25	3	8.8	**0.27**	0.872
	-Prolonged QT interval	3							**NS**

Responses are not mutually exclusive **NS**: No significant differen**ce**

Table 6 shows that, the most common GIT manifestations associated with hypermagnesemia were nausea and vomiting in percentage of 66.6% in the 1st, 2nd assessment, and 33.3% in the 3rd assessment. As regards hypomagnesemia, the most common associated neurologic

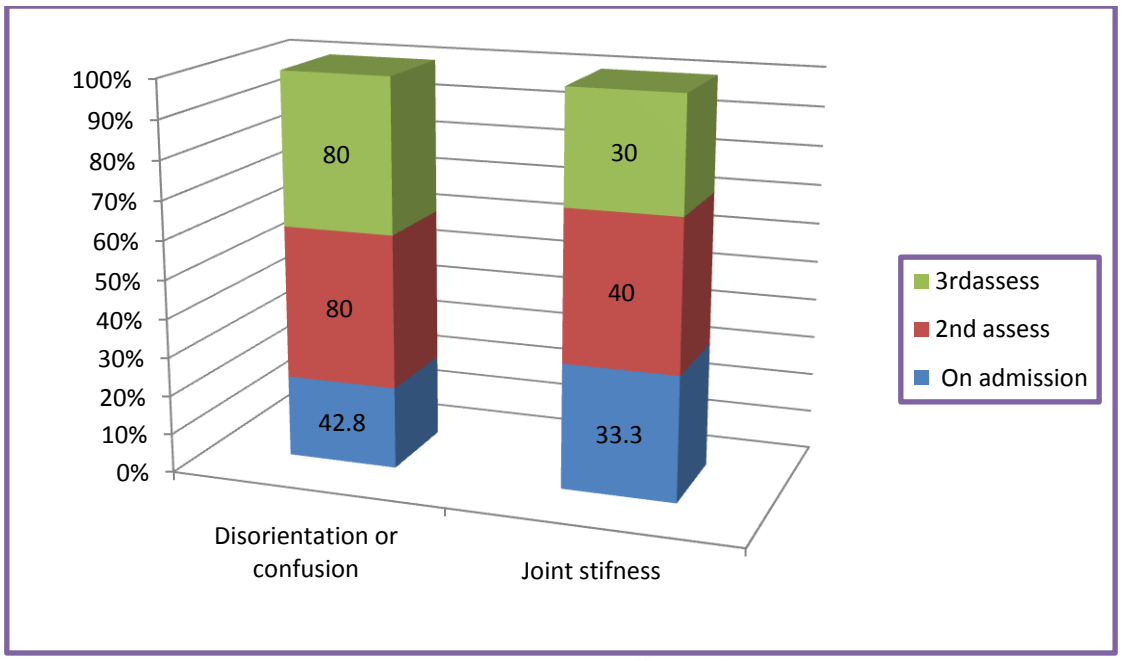
manifestations were disorientation / confusion in percentage of 62%, 47%, and 40% respectively in different assessment times. The majority of patients had muscle weakness in percentage of 93.1%, 100%, and 80% respectively. No significance differences were found in signs and symptoms of hyper and hypomagnesaemia at the three assessment times.

Table 6: Frequency Distribution of the Studied Sample according to Signs and Symptoms of Hyper and Hypo-magnesemia in Different Assessment Times

Electrolyte disturbances	Manifestations On body systems	0n admission		2nd assessment		3rd assessment		χ^2	P. value
		N. 3	%	N. 3	%	N. 3	%		
Hypermagnesemia	**GIT**								
	-Nausea	2	66.6	2	66.6	1	3.33		
	-Vomiting	2	66.6	2	66.6	1	3.33		
Manifestations on body systems		**N. 29**	**%**	**N. 21**	**%**	**N. 20**	**%**	χ^2	**P. value**
Hypomagnesemia	**Nervous system**								
	-Disorientation	18	62.0	10	47.6	8	40.0	2.48	0.289
	/confusion	14	48.0	8	38	4	20.0	4.01	0.131
	-Increased reflexes	1	3.4	1	4.7	1	5.0	0.09	0.958
	-Drowsiness	2	6.8	2	9.5	1	5.0	0.32	0.852
	-Hypoactive reflexes	7	24.1	6	28.5	4	20.0	0.41	0.814
	-Numbness	9	31.0	8	38.0	8	40.0	0.49	0.783
	-Tingling of finger, toes								
	Musculoskeletal system	27	93.1	21	100	16	80.0	5.41	0.067
	-Muscle weakness	4	13.7	2	9.5	3	15.0	0.31	0.855
	-Muscle cramps								

Responses are not mutually exclusive. **NS**: No significant difference

Figure 3 shows that disorientation / confusion was the most common neurologic manifestations among patients with phosphorus deficiency in percentage of 42.8% in the 1st assessment, and 80% in the 2nd and 3rd assessment respectively. A significant statistical difference was found in the percentage of patients who had disorientation /confusion in the second and third assessments as compared to the first (χ^2 =8.23, p= 0.016). Joint stiffness was found in percentage of 33.3%, 40%, and 30% respectively in the three assessment times.



Responses are not mutually exclusive.

Figure 3: Percentage Distribution of the Studied Sample according to Signs and Symptoms of Hypophosphatemia in Different Assessment Times

Table 7 shows that, the most common cause of electrolyte alterations were gastrointestinal problems such as anorexia to food, vomiting, and anorexia to fluid, diarrhea, and difficult swallowing in percentages of 77%, 69%, 52%, 41%, and 40% respectively.

Table 8 shows no significant statistical differences in serum electrolytes in relation to occurrence of vomiting, anorexia to food and fluid. However, significant statistical differences were found in the mean serum calcium and mean serum magnesium in relation to diarrhea ($t=3.494$, $p\leq0.001$, and $t=2.016$, $p\leq0.04$ respectively). As well, the mean serum potassium, and serum phosphorus differed significantly in relation to fluid status ($F=0.009$, $p\leq0.009$ and $F=4.403$, $P\leq0.015$ respectively).

Table 9 shows no significant statistical difference in the mean serum electrolyte values in relation to age, gender, length of ICU stays and patient`s prognosis. However, the mean of serum sodium and serum calcium differed significantly in relation to diagnosis ($F=2.666$, $P\leq0.037$ and $F=4.019$, $P\leq0.005$).

Table 7: Factors Predisposing to Electrolyte Imbalances among the Studied Sample on Admission (N=100)

Factors	No	%
Vomiting		
- Yes	69	69.0
- No	31	31.0
Frequency (per day)		
- 2-4	41	59.4
- 5-7	19	27.5
- 8-10	9	13.1

Duration (days)		
- 1-2	23	33.3
- 3-5	46	66.7
Diarrhea		
- Yes	41	41.0
- No	59	59.0
Frequency (per day)		
- 2-4	31	75.6
- 5-7	7	17.1
- 8-10	3	7.3
Duration (days)		
- 1-2	21	51.2
- 3-5	20	48.8
Anorexia to fluid		
- Yes	52	52.0
- No	48	48.0
Duration (days)		
- 1-2	25	48.1
- 3-5	27	51.9
Anorexia to food		
- Yes	77	77.0
- No	23	23.0
Duration (days)		
- 1-2	34	44.2
- 3-4	34	44.2
- 5-7	9	11.6
Difficult swallowing		
- Yes	40	40.0
- No	60	60.0
Duration (days)		
- 1-2	14	35.0
- 3-4	20	50.0
- 5-15	6	15.0

Responses are not mutually exclusive

Table 8: Comparison of Mean Serum Electrolytes in Relation to Predisposing Factors for Imbalance on Admission (N=100)

Variables	Mean sodium	Mean potassium	Mean calcium	Mean magnesium	Mean phosphorus
Vomiting					
Yes	127.99±8.70	3.79±1.41	9.03±2.56	1.78±0.61	3.88±1.97
No	129.16±9.29	3.42±1.11	8.76±2.42	1.79±0.48	3.25±1.59
Test of significance	t=0.612 p≤0.542 NS	t=1.301 p≤0.196 NS	t=0.492 p≤0.624 NS	t=0.031 p≤0.975 NS	t= 1.549 p≤0.125 NS
Diarrhea					
Yes	128.63±8.85	3.73±1.34	7.96±1.09	1.65±0.51	3.76±1.91
No	128.15±8.93	3.64±1.35	9.66±2.97	1.89±0.59	3.63±1.87
Test of	t=0.266	t=0.330	t=3.494	t=2.016	t=0.327

significance	p≤0.791 NS	p≤0.742 NS	p≤0.001**	p≤0.047*	p≤0.745 NS
Anorexia to fluid					
Yes	128.75±8.82	3.65±1.47	8.99±2.49	1.81±0.62	3.87±2.02
No	127.92±8.97	3.71±1.19	8.90±2.56	1.77±0.50	3.49±1.70
Test of significance	t= 0.468 p≤0.641 NS	t=0.240 p≤0.811 NS	t=0.190 p≤0.850 NS	t=0.272 p≤0.786 NS	t=1.006 p≤0.317 NS
Anorexia to food					
Yes	128.58±8.81	3.59±1.29	9.05±2.59	1.81±0.58	3.68±1.98
No	127.62±9.14	3.98±1.47	8.61±2.24	1.73±0.51	3.71±1.51
Test of significance	t=0.458 p≤0.648 NS	t=1.240 p≤0.218 NS	t=0.731 p≤0.466 NS	t=0.581 p≤0.563 NS	t=0.094 p≤0.925 NS
Fluid status					
Excess	128.97±9.76	4.15±1.48	8.77±2.17	1.91±0.47	4.45±2.15
Balanced	130.85±7.38	4.16±1.44	10.51±3.61	1.93±0.77	3.92±2.34
Deficit	127.48±8.70	3.34±1.14	8.71±2.32	1.70±0.55	3.24±1.47
Test of significance	F=0.862 p≤0.426 NS	F=8.914 P≤0.009*	F=2.745 P≤0.069 NS	F=1.755 P≤0.178 NS	F=4.403 P≤0.015*

***:** Significant at p≤ 0.05 ** Significant at p≤0.001 NS**:** No significant difference

Table 9: Comparison of Mean Serum Electrolyte Values in relation to Demographic & Medical Data of the Studied Sample (N=100)

Mean ± SD **Variables**	**Serum sodium**	**Serum potassium**	**Serum calcium**	**Serum magnesium**	**Serum phosphorus**
Age					
20-25	125.17±12.	2.87±0.52	7.50±1.34	1.52±0.57	2.12±0.65
26-45	3	4.03±1.66	9.19±1.97	1.74±0.52	3.99±1.59
46-60	129.88±7.0	3.67±1.28	8.99±2.67	1.82±0.58	3.74±1.95
	128.3±8.9				
Test of significance	F=0.529 P≤0.529 NS	F=1.72 P≤0.184 NS	F=0.762 P≤0.469 NS	F=0.889 P≤0.414 NS	F=2.404 P≤0.096 NS
Gender					
Male	128.57±9.6	3.50±1.13	8.75±2.27	1.78±0.57	3.36±1.78
Females	7	3.77±1.43	9.05±2.64	1.79±0.57	3.86±1.92
	128.23±8.4				
	6				
Test of significance	t=0.183 P≤0.856 NS	t=0.978 P≤0.330 NS	t=0.574 P≤0.567 NS	t=0.067 P≤0.947 NS	t=1.276 P≤0.205 NS
Diagnosis					
Hematologic	130.88±8.6	3.53±1.32	8.21±1.45	1.85±0.59	3.71±1.99
Breast cancer	3	3.15±0.82	11.28±3.39	1.65±0.67	3.29±1.21
Respiratory	125.31±7.9	3.68±1.44	9.31±2.61	1.66±0.30	3.15±1.55

Digestive	9	4.01±1.53	9.22±2.99	1.93±0.54	4.04±2.22
Others	122.20±5.49	4.06±1.41	8.78±2.63	1.77±0.58	3.90±1.98
	129.67±9.11				
	127.81±9.40				
Test of significance	F=2.666 p≤0.037*	F=1.366 p≤0.251 NS	F=4.019 P≤0.005*	F=0.601 P≤0.663 NS	F=0.496 P≤0.738 NS
Length of stay					
2-4 days	129.28±9.59	3.84±1.18	8.40±1.96	1.82±0.61	3.64±2.06
5-6 days		3.60±1.35	9.81±2.97	1.70±0.53	3.59±1.84
7-10 days	128.10±7.83	4.17±1.53	8.91±2.63	1.84±0.54	3.89±1.59
	126.83±7.79				
Test of significance	F=0.615 p≤0.542 NS	F=2.249 P≤0.111 NS	F=2.886 P≤0.061 NS	F=0.495 P≤0.611 NS	F=0.196 P≤0.863 NS
Prognosis					
Dead	127.88±9.25	3.61±1.23	9.01±2.58	1.84±0.59	3.86±1.94
Improved	129.34±7.99	3.84±1.54	8.82±2.38	1.67±0.50	3.44±1.73
Test of significance	t=0.768 p≤0.444 NS	t=0.802 p≤0.424 NS	t=o.352 p≤0.725 NS	t=1.465 p≤0.146 NS	t=0.893 p≤0.374 NS

***:** Significant at p≤ 0.05 **NS:** No significant statistical difference.

Table 10 shows no significant statistical correlation between serum electrolyte levels and; age, body mass index, and length of ICU stay in different assessment times.

Table 10: Correlation between Serum Electrolyte Values and Age, Body Mass Index Values in Different Assessment Times (N=100)

Variables	Age		BMI values		Length of ICU stay	
	r	P	r	r	r	P
Serum Sodium						
On admission	0.006	0.955	0.186	0.064	-0.130	0.196 NS
2nd assessment	-0.083	NS	0.077	NS	-0.189	0.060 NS
3rd assessment	-0.114	0.414 NS	0.070	0.447 NS	-0.005	0.959 NS
		0.258NS		0.488 NS		
Serum Potassium						
On admission	0.013	0.897	0.116	0.252	0.150	0.137 NS
2nd assessment	-0.034	NS	0.127	NS	0.094	0.353 NS
3rd assessment	-0.074	0.737 NS	0.117	0.207 NS	0.001	0.990 NS

		0.462 NS		0.247 NS		
Serum Calcium						
On admission	0.070	0.495	-0.067	0.514	0.094	0.357 NS
2nd assessment	0.025	NS	-0.065	NS	0.096	0.346 NS
3rd assessment	-0.016	0.804 NS	0.029	0.525 NS	0.105	0.301 NS
		0.873 NS		0.774 NS		
Serum Magnesium						
On admission	0.091	0.371	-0.019	0.851	-0.037	0.716 NS
2nd assessment	0.057	NS	-0.008	NS	-0.107	0.294 NS
3rd assessment	-0.006	0.577 NS	-0.064	0.934 NS	-0.016	0.876 NS
		0.953 NS		0.529 NS		
Serum phosphorus						
On admission	0.098	0.335	0.147	0.148	0.034	0.740 NS
2nd assessment	0.120	NS	0.102	NS	-0.036	0.724 NS
3rd assessment	0.073	0.238 NS	0.094	0.314 NS	0.003	0.976 NS
		0.472 NS		0.355 NS		

NS: No significant statistical difference.

DISCUSSION

The present study revealed that nearly half of the studied sample was admitted to the ICU with neutropenic fever or febrile neutropenia (FN) as oncologic emergency. This finding is consistent with that of Shaikh, et al., (2011) who carried out a study about incidence and impact of baseline electrolyte abnormalities among oncology patients and demonstrated that, the majority of patients were admitted with a diagnosis of chemotherapy induced FN. In this regards Zimmer & Freifeld, (2019) indicated that, FN is often the first and sometimes the only sign or symptom of infection in cancer patients receiving cytotoxic chemotherapy.

As well, Rasmy, Al Mashiakhi & Ameen, (2017), revealed that FN is one of the most common and risky complications of chemotherapy. It occurs within 6-8 days with standard chemotherapy. It is caused by bacteria, fungi or viruses and is responsible for patients' morbidity, and in-hospital mortality. This could be the rationale of having hyperthermia among more than half of the studied sample on admission to the ICU and in the second assessment time. So, utilization of in-hospital preventive measures and management are necessary.

Having nearly half of the studied patients with FN doesn't suggest ignorance of the other one quarter who had TLS. The dominance of TLS was reported by Coiffier, Altman, Pui, Younes & Cairo, (2008) who carried out a retrospective study on patients with high-grade Non-Hodgkin Lymphoma (NHL). In this regards, Mika, Ahmed & Guruvayoorappan, (2012)

revealed that, the incidence of oncologic emergencies depends on age, gender, type of malignancy, type of chemotherapy, number of cycles and sensitivity of cancer cells to anticancer therapy.

Middle aged adults (between 46-60 years old) represented three quarters of the current study sample. This finding is in the same line with that of Yang, et al., (2018) who carried out a study about oncologic emergencies in one of the cancer emergency departments and found the age of involved patients peaked at 46-60 years. This age category "From the investigators point of view" is commonly associated with chronic health problems, along with disability or disease, in addition to increased their sensitivity to stress. Also, Dale, (2010) carried out a study about neutropenic fever in cancer patients and revealed that age is a very important risk factor for FN when beginning chemotherapy because of the associated comorbidities.

In relation to gender, the present study demonstrated that, two-thirds of the studied sample were females. In this regards Lyman, Abella & Pettenell, (2013), and Alberta Health Services (2017) revealed that, in addition to age, female gender is a risk factor for neutropenic fever. This finding is contradicted with that of Balci, et al., (2013) who carried out a study about general characteristics of patients with electrolyte imbalance admitted to emergency department, and revealed the dominance of males. Also, Shaikh, et al., (2011) found equal number of males and female oncology patients admitted to the hospital. Middle-aged women in the current study "from the investigators' point of view" are expected to experience hormonal changes / pre-menopause symptoms which may increase their risks for hypertension, heart problems, and so their probability of having oncologic emergencies.

Concerning diagnosis, the present study revealed that, hematological, breast, and digestive organ cancers were prevalent among the studied sample. This finding is in the same line with that of Yang, et al., (2018) who revealed that hematological, breast, and gastrointestinal cancers were most common diagnoses in the emergency department. However, Sadik, et al., (2014) and Mayer, Travers, Wyss, Leak, & Waller (2011) found lung, colorectal, and breast cancers to be the most common diagnoses admitted to the emergency department.

The majority of the studied sample received chemotherapy and a minority received chemo-radiotherapy. In this regards, Mofid, Novin, Roointan & Forouzanfar, (2016) carried out a study about epidemiology and death-related factors among oncology patients and provided contradicting findings where more than half of the studied sample admitted to the emergency department after receiving chemo-radiotherapy and only one quarter were treated with chemotherapy. The dominance of chemotherapy as anticancer treatment in the current study "from the investigators' point of view" maybe due to the fact that the selected data collection setting is concerned with providing chemotherapy and surgical intervention. However, other anticancer treatments such as radiotherapy are given in different units.

The most commonly noticed GIT complications associated with anti-cancer treatment among the studied patients were vomiting, nausea, and diarrhea. That is why more than half of the studied sample had nothing per mouth (NPO) because of their inability to drink or eat. This was also reflected on patients' fluid volume status as fluid volume deficit was noticed among the studied sample. In concordance with this finding was that of Nurgali, Jagoe & Abalo

(2018) who carried out a study about adverse effects of cancer chemotherapy and revealed that nausea and vomiting were amongst the most feared side effects for cancer patients receiving chemotherapy.

As well, Lima, Andrade, Gomes & Batista, (2012) carried out a study about dietetic management in gastrointestinal complications from anti-malignant chemotherapy and revealed that nausea, vomiting, and diarrhea were among the most frequent adverse effects. Therefore, anticipation, prevention and treatment of complications associated with anticancer treatment should begin as early as possible to avoid worse progress and occurrence of fluid / electrolyte imbalances, dehydration, weakness, and weight loss.

ANSWERING THE STATED RESEARCH QUESTIONS

Concerning the first research question, the present study revealed that hyponatremia, hypokalemia, and hypocalcemia were the most common electrolyte imbalances among patients with oncologic emergencies in different assessment times. This finding is in agreement with that of Anand & Nikhil, (2015), who carried out a study about incidence and spectrum of electrolyte disturbances in cisplatin-based chemotherapy and found hyponatremia, hypocalcemia, and hypokalemia to be common among the majority of patients. They revealed that the type of electrolyte imbalance may be related to the type of chemotherapy used.

More specifically, hyponatremia was found approximately among three quarters of the studied sample, with significant statistical differences in the mean serum sodium levels at all assessment times. Hyponatremia as indicated by Dalkin & Rosner, (2014) is the most common electrolyte disorder encountered in patients with malignancies. It occurs as a result of cancer treatment, malnutrition, reduced gastrointestinal / renal function, and / or paraneoplastic syndromes of inappropriate antidiuretic hormone secretion (SIADH) (Castillo, Vincent, & Justice, 2012). It is clearly associated with significant morbidity, mortality, and increased hospital length of stay. It may affect patient response to therapy, and limit the use of chemotherapeutic options that require extensive hydration (Doshi, Shah, Lei, Lahoti & Salahudeen, 2012 In Dalkin & Rosner, 2014).

Finding of the present study is in agreement with that of Mousavi, et al., (2012) who compared serum electrolyte levels among patients who died and survived in the intensive care unit and showed that, hyponatremia was significantly more common among ICU patients. As well, Balci, et al., (2013) reported that sodium imbalance was most commonly noticed among the majority of patients. In addition, Shaikh, et al., (2011) found hyponatremia as the most common disturbance in electrolytes in more than two thirds of patients.

Concerning hypokalemia, it was found among half of the studied sample. It is the second most common electrolyte disorder encountered in patients with cancer (O'Regan, Carson, Chesney, & Drummond, 1977 In Dalkin & Rosner, 2014). Hypokalemia is multifactorial, and is commonly seen in conjunction with other electrolyte disorders such as hyponatremia and hypomagnesemia and reflects the underlying etiologies such as diuretic use. Hypokalemia may be associated with medications that can cause tubular damage (such as cisplatin, ifosfamide, amphotericin B, and aminoglycoside antibiotics); gastrointestinal and kidney

losses of potassium. Hypokalemia may occur in patients with hypercalcemia due to the kaliuretic effect of the elevated calcium level as well as due to the injudicious use of diuretics in this population (Aldinger & Samaan,1977 In Dalkin & Rosner, 2014).

As regards hypocalcemia, it was found among approximately half of the studied sample. This finding is in the same line with that of Blaci, et al., (2013) who found hypocalcemia among more than half of the studied sample. Hypocalcemia was observed in certain types of leukemia or blood disorders, and as a complication of chemotherapy. It is commonly noticed in patients with TLS as large amount of tumor cells are killed off at the same time by the treatment, releasing their contents in the bloodstream. This may cause hypocalcemia and other electrolyte abnormalities (Davidson, et al., 2004). So, the nurse should assess calcium level and examine for signs and symptoms of its disturbance.

As regards the second research question, the current study revealed that hyponatremia is a common electrolyte disturbance. The majority of patients with hyponatremia had disorientation or confusion at the three assessment times, more than half of these patients had dry mucus membrane and hallucination (irrelevant talks). This finding is in the same line with that of Allan & Ganguly, (2015) who carried out a study about hyponatremia and revealed that slowly evolving hyponatremia is frequently asymptomatic, non-specific symptoms generally develop when serum sodium levels drop below 120 mmol/L. These symptoms include fatigue, lethargy, weakness, and confusion. Seizer and coma are un common. Also, Rao, et al., (2010) carried out a hospital-based descriptive study of symptomatic hyponatremia in elderly patients and demonstrated that; lethargy, drowsiness with slow response and irrelevant talk were the common presenting symptoms. Therefore, the nurse should assess the patient`s neuromuscular status periodically (during each nursing shift) for changes from the baseline, observe and document patients' level of consciousness, behavior, and mental status.

Hypokalemia was the second most frequent electrolyte disturbance among half of studied sample. Assessment revealed that, approximately half of patients with hypokalemia had GIT disturbance (anorexia, nausea, and vomiting), and slurred speech among. This finding is in agreement with that of Kraft, Btaiche, Sacks & Kudsk, (2005) who carried a study about treatment of electrolyte disorders in adults in the ICU and reported that nausea, vomiting, weakness, constipation, and paralysis were the signs and symptoms of hypokalemia. In this regards Ignatavicius & Workman, (2011) revealed that intestinal changes occur with hypokalemia because of decreased GIT smooth muscle contractions, leading to decreased peristalsis. Patient may have hypoactive bowel sounds, nausea, vomiting, constipation, and abdominal distention; in patient with sever hypokalemia paralytic ileus may occur.

Consequently, Blaci, et al., (2013) revealed that confusion, paresis, and aphasia were the most common neurologic manifestations in patients with hypokalemia. Moreover, Ignatavicius & Workman, (2011) illustrated cardiovascular changes associated with hypokalemia, and revealed that ST segment depression (in the ECG rhythm) was the most frequent and worse symptom of hypokalemia. Dysrhythmia also may occur, and it can range from very slow to very rapid, irregular heartbeat. This could be the rationale of having tachycardia among more than half of the studied sample on admission to the ICU. Therefore,

the nurse should assess peripheral pulses, monitor ECG rhythms, and measure arterial blood pressure.

Inspite of having hypokalemia among around three quarters of the studied sample, hyperkalemia was found among nearly one quarter of the studied sample. The most common manifestations associated with hyperkalemia were GIT disturbances and ECG changes. This finding is in the same line with that of Taylor, Lillis, Lynn, & LeMone (2015) who revealed that hyperkalemia is considered as the most common cause of death as a result of cardiovascular changes, and cardiac dysrhythmias. As serum potassium level rises, heartbeats generate outside normal conduction system in the ventricles, and changes in ECG waveforms can be noticed. Life threatening complications such as sever heart block, sudden cardiac arrest / a systole, and ventricular fibrillation may occur. Other symptoms associated with hyperkalemia include diarrhea, nausea, muscle weakness, and paresthesia.

The third most frequent electrolyte imbalance was hypocalcemia among nearly half of the studied sample. Disorientation or confusion, and seizure were the most frequent findings when examining patients with hypocalcemia in different assessment times. In this regards Khan, Dellinger & Waguespack, (2018) revealed that, sever hypocalcemia can present with seizure, laryngospasm, bronchospasm, arrhythmias due to a prolonged QT interval, or altered mental status. As well, Han, Trinidad, and Shi (2015) indicated that common neurological manifestations of hypocalcemia include tetany, seizure, and delirium as a result of increased excitability in the central nervous system. It is also frequently accompanied by colicky gastrointestinal symptoms, suggesting hyperexcitability in the vagal nerve system. Therefore, the nurse should consider seizure precautions for patients with hypocalcemia. Emergency drugs and equipment such as oxygen sources and devices, suction machines, and endotracheal tube trays are necessary and must be available. The nurse must make sure that patient has IV access, a patent airway, the bed is kept at the lowest position, and bed side rails are raised.

The present study revealed hypomagnesaemia among more than one quarter of the studied sample, and most commonly they had musculoskeletal and nervous system alteration. Most commonly studied patients had muscle weakness on admission to the ICU, disorientation / or confusion. This finding is in the same line with that of Timby & Smith (2014) who revealed that hypomagnesaemia is associated with tachycardia, neuromuscular irritability, leg and foot cramps, seizure, and mental changes. As well, Green, Valero & Perkowski (2015) carried out a study about identifying and treating magnesium deficiency in cancer patients receiving platinum-based chemotherapy and revealed that serum hypomagnesaemia is frequently observed in more than two thirds of patients in the ICU.

Hypophosphatemia was also found among the studied sample and it was manifested by disorientation /or confusion. In this regard Rosner & Darken (2014), revealed that serum magnesium and phosphorous are not examined routinely in blood test, and they are generally masked by other electrolyte deficiencies. Magnesium and phosphorus "From the investigators point of view" don’t have specific manifestations as they presented with variety of symptoms such as nausea, vomiting, weakness, irritability, and confusion which are commonly seen as side effects of chemotherapy. That is why Burke et al., (2014) indicated that, the nurse should

monitor vital signs and notify the physician immediately especially if there are changes in respiratory rate, rhythm, depth or any changes in cardiac condition.

Concerning the third research question, the present study revealed that anticancer drug associated gastrointestinal (GIT) problems were the most common predisposing factor for electrolyte imbalance. More than three quarters of the studied sample had nausea, more than two thirds had vomiting, more than half had anorexia, and nearly half had diarrhea. This finding is in the same line with Onitilo, Kio, & Doi, (2007) who carried out a study about tumor-related hyponatremia which revealed that, electrolyte disturbances may be related to malignancy-associated pain or chemotherapy-induced nausea and vomiting.

As well, Bryniarski, et al., (2017) carried out a study about evaluation of prognostic factors, symptoms and consequences of dehydration in patients with cancer and revealed a clear correlation between nausea, vomiting and dehydration. Dyselectrolytemia occurs almost five times more frequently in dehydrated individuals. This is of special concern especially where around two thirds of the studied sample had fluid volume deficit. However, no significant statistical differences were found in serum electrolytes in relation to occurrence of vomiting, anorexia to food and fluid volume status.

The mean serum calcium and magnesium levels differed significantly in relation to presence of diarrhea in the current study. In this regards Vekarya, Bharodiya, Srivastav, (2017) carried out a study about serum magnesium level in acute diarrhea and revealed that more than half of the cases of acute diarrhea had developed hypomagnesemia. There were significant statistical differences in mean of serum magnesium in relation to diarrhea but there was no significant association between calcium level and grades of dehydration in cases of acute diarrhea.

Consequently, the current study revealed that around two thirds of the studied sample had fluid volume deficit, one third was underweight, and the great majority received hydration therapy on admission to the ICU. This finding is the same line with that of Dala & Bruera, (2004) who carried out a study about dehydration in cancer patients: to treat or not to treat and revealed that the great majority of patients in the terminal phase of their illness experience severely reduce oral intake due to the malignancy itself, or its treatment.

Maintenance of fluid and electrolyte balance in critically ill cancer patients is challenging due to the disease process itself and / or the physiological changes associated with aging. In addition, hydration therapy "From the investigators' point of view" may be a cause of electrolyte imbalance. High rate of fluid volume replacement may predispose to electrolyte shift from intracellular to extracellular space and quickly exacerbate hypokalemia, hypomagnesemia, hypophosphatemia, hyponatremia and other electrolyte disturbances which complicate cancer patients' management. Therefore, careful assessment and management of symptoms associated with chemotherapy induced fluid and electrolytes imbalance is an important nursing responsibility. Such assessment and interventions can prevent / minimize further deterioration and complications, so reducing ICU length of stay, and costs of care.

RECOMMENDATIONS

Continuous assessment and monitoring for critically ill patients undergoing chemotherapy for early detection and prevention of oncological emergencies; provision of lifesaving and immediate interventions to prevent further deteriorations; carrying out rehabilitation programs for patients undergoing chemotherapy to avoid oncological emergencies; and provision of oncology patients with written instructional guidelines about how to recognize side effects of chemotherapy, and when to seek medical interventions.

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