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Role of Intensive Care Unit in a Medical Oncology Department

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Abstract—*Over a 4-year period, 912 patients were admitted to the ICU of the medical oncology service at the Institut Jules Bordet: 574 (63%) were admitted for medical emergencies and 338 (37%) for intensive treatment and/or monitoring.*

In the first group, the main causes of admission were hypercalcemia, thromboembolic disease, cardiac arhythmias, encephalopathies and pneumopathies. Overall mortality during the ICU stay was 23% (133/574).

In the second group, patients were admitted primarily in order to receive, under optimal surveillance, anticancer treatment, either because they were at high risk of complications or because the approach was mainly investigational; several investigations, in the fields of supportive care and anticancer treatment, were successfully conducted within the ICU environment.

INTRODUCTION

CANCER PATIENTS are often not considered to be appropriate candidates for admission to intensive care units (ICU) because life-threatening complications are thought to be associated with the very high mortality rate among these patients [1], particularly if they develop acute respiratory failure [2]. However, various oncological and/or medical emergencies requiring intensive care facilities can now be successfully treated in these patients [3]. Moreover, the present development of medical oncology sometimes requires intensive therapy of cancer itself, necessitating a close monitoring of the patients. Moreover, the ICU also authorizes the administration of new compounds for which only preclinical data are available under optimal safety conditions (phase I studies). Intensive care facilities have thus become a necessity for the treatment of cancer patients and for the monitoring of new therapeutic approaches.

Information about the role of intensive care units in cancer centers is limited. Turnbull *et al.* [4] have published a short editorial about the intensive care unit at the Memorial Cancer Center in New York; 1035 patients were admitted during a 3-year period (1971–1974) for life-threatening complications and the majority of them (76%) came from the surgical services; the overall mortality was 22%.

Because at the Jules Bordet Institute the medical service has its own ICU, different from the surgical ICU, we have been able to focus on the types of patients admitted to a medical oncology ICU and to evaluate the results of intensive care.

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MATERIAL AND METHODS

The medical ICU, at the Institut Jules Bordet, is a five-bed unit integrated in the medical service. Critical care facilities are available, such as artificial ventilation, hemodynamic monitoring or protective isolation in a single room. Cardiac monitoring is applied to each patient. The unit is under the direction of a medical oncologist trained in critical care medicine and direct medical care is performed by a full-time resident. Nursing is provided by a special staff; nurses work alternately in the ICU and in the general ward in order to maintain a broad experience in managing cancer patients. The nurse–patient ratio in the ICU varies between 1/5 and 3/5 depending on the needs.

The causes of admission, the nature of the underlying diseases and the ultimate results were reviewed for each patient admitted to the ICU during a 4-year period (October 1981–October 1985). During this period, patients were under the supervision of the same physicians and nurses.

RESULTS

Nine hundred and twelve patients were admitted to the ICU during a 4-year period: 574 (63%) for medical emergencies and 338 (37%) for intensive

Table 1. Underlying diseases of the patients admitted in the ICU

Underlying disease	Medical complications	Intensive monitoring
A. Solid tumors	437 (76%)	229 (68%)
Brain	5 (1%)	—
Head and neck	53 (9%)	36 (11%)
Thyroid gland	5 (1%)	1
Lung	106 (18%)	108 (32%)
Breast	149 (26%)	29 (9%)
Hepatoma	2	—
Esophagus	9 (2%)	2
Stomach	6 (1%)	1
Colon	10 (2%)	(2%) 8
Anus	2	—
Adrenal glands	3	2
Kidney	3	3 (1%)
Bladder	6 (1%)	—
Prostate	11 (2%)	1
Ovary	18 (3%)	18 (5%)
Endometrium	8 (1%)	—
Uterine cervix	17 (3%)	3 (1%)
Vulva	1	—
Testis	3	1
Soft tissues	5 (1%)	—
Melanoma	8 (1%)	12 (4%)
Bone	—	1
Unknown origin	7 (1%)	3 (1%)
B. Malignant hemopathies	99 (17%)	97 (29%)
Hodgkin's disease	9 (2%)	8 (2%)
Non-Hodgkin's lymphoma	33 (6%)	28 (8%)
Dysmyelopoietic syndrome	1	2
Myeloproliferative syndrome	13 (2%)	6 (2%)
Acute lymphoblastic leukemia	8 (1%)	5 (1%)
Acute non lymphoblastic leukemia	20 (3%)	33 (10%)
Chronic lymphoblastic leukemia	2	1
Multiple myeloma	13 (2%)	14 (4%)
C. Non-neoplastic diseases	38 (7%)	6 (2%)
D. Bone marrow donors	—	6 (2%)
Total	574	338

treatment and/or monitoring. As shown in Table 1, the majority of the patients had cancer as the underlying disease. Only 50 admissions (5.5%) involved patients without cancer.

Of the 574 patients admitted for medical emergencies, 76% had solid tumors and 17% hematological malignancies. The most frequent tumors, reflecting the hospital's specialization, were breast cancer (26%), lung cancer (18%), head and neck cancer (9%), lymphoma (8%) and leukemia (7%). Medical complications requiring admission to the ICU are shown in Table 2.

The most frequent reason for admission was hypercalcemia: 10%. This was followed by thromboembolic disease (7%); cardiac arhythmias (7%); encephalopathies (6%); and diffuse pneumopathies (5%). Admissions for coronary problems amounted only to 2% and those for drug intoxication to less than 1%. Overall mortality during the ICU stay was 23% (133/574). The most frequently fatal problems were hepatic failure (85%), meningeal carcinomatosis (75%), septic shock (63%), other types of shock (50%) and pneumonia (43%). Mortality was 22% for hypercalcemia, 10% for thromboembolic disease and 11% for cardiac arhythmias.

New treatments were applied to patients for the management of hypercalcemia and fungal infections: aminohydroxypropylidene diphosphonate (APD) was administered intravenously to hypercalcemic patients with 100% success and without major side-effects [5]; a phase I study [6] was initiated in patients with fungal infections in order to test the tolerance of the intravenous administration of amphotericin B trapped in sonicated liposomes.

Three hundred and thirty-eight patients were admitted for intensive monitoring and/or treatment.

Table 2. Types of medical complications requiring admission in the ICU and mortality observed during the ICU stay

	Number of cases (%)	Mortality (number of observed deaths)
Thrombo-embolic disease	42 (7%)	10% (4)
Cardiac arhythmias	38 (7%)	11% (4)
Cardiac failure	14 (2%)	7% (1)
Coronary problems	10 (2%)	10% (1)
Pericardial complications	11 (2%)	9% (1)
Upper respiratory failure	16 (3%)	12% (2)
Pleural effusion	10 (2%)	— —
Pneumothorax	5 (1%)	20% (1)
Diffuse pneumopathies	30 (5%)	23% (7)
Superior vena cava syndrome	8 (1%)	25% (2)
Pneumonia	28 (5%)	43% (12)
Other respiratory failures	17 (3%)	35% (6)
Septicemia	17 (3%)	24% (2)
Infections during leucopenia	27 (5%)	19% (5)
Septic shock	24 (4%)	63% (15)
Hypovolemic shock	10 (2%)	30% (3)
Various shock	12 (2%)	58% (7)
GI bleeding	23 (4%)	9% (2)
Various bleeding	10 (2%)	50% (5)
Acute renal failure	17 (3%)	6% (1)
Hypercelcemia	59 10%)	22% (13)
Acute abdomen	21 (4%)	14% (3)
Ascitis	11 (2%)	— —
Hepatic failure	13 (2%)	85% (11)
Various encephalopathies	35 (6%)	6% (2)
Infectious meningitis	10 (2%)	50% (5)
Carcinomatous meningitis	12 (2%)	75% (9)
Intracranial hypertension	18 (3%)	28% (5)
Epilepsy	9 (2%)	22% (2)
Carcinomatous epiduritis	6 (1%)	— —
Other causes	11 (2%)	— —
Total	574	23% (133)

Underlying diseases (Table 1) were basically the same for these patients and for those admitted for medical emergencies. However, there were more patients with lung cancer (32%) than with breast cancer (9%), perhaps reflecting a different approach in the management of these two types of tumors. The overall mortality of this group of patients during their stay in the ICU was very low: 1.5% (5/338). Table 3 shows the main causes of admissions. Basically three types of patients were admitted: those who received a standard treatment but were at risk because of serious underlying diseases; those who underwent an intensive treatment or procedure requiring intensive supportive care; and finally, those who were given a new drug in a phase I study requiring close monitoring.

As a matter of fact, several tests were conducted and required the use of the medical ICU during the study period. A late intensive chemotherapy program with autologous bone marrow transplantation was conducted in patients with small cell lung cancer [7–9]. A phase I study of Marcellomycin, a new anthracyclin with potential cardiac toxicity, was performed under close cardiac monitoring [10]. Hydrophobic cytostatic compounds, NSC 251635 and 6-aminochrysene, trapped in liposomes, were administered intravenously [11]. A pilot study of intraperitoneal chemotherapy with cisplatin and melphalan was also performed.

DISCUSSION

This study analyzing the causes of admission in a medical oncology ICU allowed us to define two main types: medical emergencies (63%) and intensive treatment and/or monitoring for anticancer therapy (37%). We have not analyzed the cause of admission according to types of cancer because of the potential bias due to the selected population referred to our cancer center.

The emergencies observed in the medical oncology ICU have a different pattern from those observed in a general ICU [12].There are very few acute coronary problems (2%) or drug intoxications (less than 1%); on the other hand, metabolic, respiratory, neurological and hematological complications are common. The main cause of admission,

Table 3. Types of admissions for intensive monitoring and treatment

	Number of cases
Intensive chemotherapy	41 (12%)
Hydrophilic cytostatic agents phase I studies	44 (13%)
Hydrophobic cytostatic agents phase I studies	57 (17%)
Intraperitoneal chemotherapy	16 (5%)
Standard chemotherapy in high risk patient	53 (16%)
Marrow harvesting	44 (13%)
Blood transfusions in high risk patient	11 (3%)
Post-anesthesic surveillance	15 (4%)
Various	57 (17%)
Total	338

during our observations, was hypercalcemia, a frequent complication of cancer.

The overall mortality for medical emergencies was 23%, a common figure in ICUs [13]; Turnbull [14] reported an overall 22% mortality. Some types of organ failure such as respiratory or hepatic insufficiency were associated with higher mortality. In other studies, severe respiratory failure in cancer patients, particularly when artificial ventilation was required [19] and/or if the underlying disease was a hematological malignancy [15–17], has also been associated with a poor prognosis. In our series cardiac problems, thromboembolic complications and GI bleeding appeared to be associated with a relatively low ICU mortality ($\leq$10%).

A potential advantage for a medical oncological department to have its own ICU directly managed by medical oncologists is the possibility of administering, under optimal surveillance, new anticancer treatments. Several clinical investigations such as the administration of APD in hypercalcemia, ampholiposomes for fungal infections, high dose chemotherapy of SCLC (and other tumors) with or without autologous bone marrow transplantation, intraperitoneal chemotherapy, intravenous administration of hydrophobic cytostatic agents entrapped in sonicated liposomes were successfully conducted in our unit [58/11]. Presumably there are many other therapies which should be given under close monitoring within a ICU; among these one can cite the recently developed adoptive immunotherapy with lymphokine-activated killer cells and interleukin-2 [20]. In addition, the control of the ICU by medical oncologists appears to be an important stimulus for the application of intensive care to cancer patients and for the use of the ICU in the development of new anticancer therapies.

In conclusion, a specific intensive care facility should be integrated into any large medical oncology service especially if it is involved in clinical investigation of new therapeutic modalities. It allows the optimal supportive care for the life-threatening complications that often occur in cancer patients and the development of new treatments under safe conditions.

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