Chapter 3

The Inpatient Unit in a Cancer Center

Mohamed A. Kharfan-Dabaja

Introduction

Treatment of cancer has evolved significantly over the past four decades, moving away from traditional chemotherapies, with or without radiation therapy, to smarter targeted therapies [1–3]. As many of these novel treatments became available in oral formulations, or as short intravenous infusions or through the subcutaneous route, this has allowed moving several regimens to be administered in the outpatient setting. This is the case for a significant number of cancer treatment regimens for diseases, such as chronic lymphocytic (CLL) and chronic myelogenous (CML) leukemias, for which the current standard therapies are administered orally [4, 5]; and for various solid neoplasms, namely, lung, breast, colon, and prostate cancer, among others, for which contemporary regimens lend themselves for administration in outpatient infusion centers. The increase in health care cost has also played an important role on supporting shifting cancer care to the outpatient setting [6].

Yet, a significant number of patients still require treatment in the inpatient setting, owing to the nature of the treatment, duration, and frequency, or to the level of supportive care required to administer such treatments, among others. Presently, the majority of cases treated in the inpatient setting include induction and consolidation therapies for acute leukemias, myeloid (AML) or lymphoid (ALL), and certain biotherapies [7, 8]. This also applies to more complex procedures like hematopoietic cell transplantation (HCT), particularly allogeneic HCT (allo-HCT), and chimeric antigen receptor T-cell therapy (CAR T) [9–13]. In the case of autologous HCT (auto-HCT), some regimens used for lymphomas are preferentially prescribed for administration in the inpatient setting, while using high-dose melphalan for

M. A. Kharfan-Dabaja (✉)

Division of Hematology-Oncology, Mayo Clinic, Jacksonville, FL, USA

Blood and Marrow Transplantation Program, Mayo Clinic, Jacksonville, FL, USA

e-mail: KharfanDabaja.Mohamed@mayo.edu

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multiple myeloma is commonly offered in the outpatient setting. Furthermore, some cancer patients may need to be hospitalized for management of their symptoms, such as intractable pain or treatment of infection(s) requiring frequent antimicrobial dosing, or for nutritional support; and/or many other complications that might have resulted from cancer treatment. In many inpatient units at cancer centers, private rooms are also available for patients who need palliative or hospice care.

Apart from specialized trained physicians and nurses, the number of inpatient team services has expanded significantly to meet the complex needs of patients and their families. Pharmacists are resourceful to help understand, guide, and manage the potential side effects of new therapies and to educate patients to better understand cancer treatment and potential benefits and complications. The pharmacy team, in coordination with physicians, nurses, and clinical research coordinators, also plays a crucial role in safeguarding the well-being of patients who are participating in clinical trials evaluating safety and efficacy of new drugs. Oncology social workers and case managers have also become an integral part of inpatient teams helping provide psychosocial support, and assist with short- or long- term placement, whenever warranted, and to coordinate discharge needs by planning and identifying needed resources for a smooth transition to the outpatient setting. Certified nutritionists, dieticians, and physical and occupational therapists are also available to assist with clinical interventions. During cancer treatment, it is also important to recognize the importance of addressing the patients' spiritual needs.

There is not a universal model for how an inpatient unit should be built and developed. This would certainly depend on several aspects including financial resources, population density, and societal factors, among others. Below, we attempt to describe the main components of an inpatient cancer treatment unit. We divide them into the human factor and other factors.

The Human Factor

Successful operation of an inpatient unit is certainly dependent on a complex and well-orchestrated multidisciplinary approach to cancer care. The inpatient unit also provides an opportunity to educate future generation of physicians, advanced practice providers, and nurses in various specialties and subspecialties, particularly hematology, medical and surgical oncology, infectious diseases, and psychiatry, among others.

The model most commonly applied in teaching hospitals comprises an inpatient attending physician that is responsible for leading and coordinating the care of patients. The team also includes trainees, generally hematology and/or medical oncology fellows and internal medicine residents, medical students, advanced practice providers, namely, physician assistants and advanced registered nurse practitioners, nurses, a pharmacist, a social worker, and a case manager. Nutritionists and physical and occupational therapists are also called upon to participate in patient care based on indicated needs. In more complex procedures like hematopoietic cell transplantation, there is ample participation of subspecialties such as infectious

diseases owing to the increased risks of opportunistic infections in the setting of profound immune suppression. For patients receiving CAR T-cell therapy, there is active participation from specialties such as neuro-oncology owing to potential-associated neurotoxicity and intensive care unit specialists. Other specialties may also end up participating in the care of CAR T-cell recipients if they develop organ failure; for example, nephrologists in the case of renal failure and cardiology in the case of cardiac dysfunction, among others. In the nonacademic community setting, similar multidisciplinary services are also available; and some community-based cancer centers also provide educational and training opportunities.

Nurses play an important role in the inpatient oncology setting as they are directly involved in the care of patients and generally the first to become aware of any change in a patient's clinical condition [14]. Patients' perceptions of excellence in health-care are strongly associated with nursing care [15]. There is not an established standard pertaining to a nurse-to-patient ratio in an oncology inpatient unit; and staffing needs depends on various factors including, but not limited to, level of acuity, volume of patients in the unit, and nursing skills in the case of complex procedures such as allo-HCT or CAR T-cell therapy. Thorough assessment of these patients is crucial to ensure optimal care and timely intervention whenever needed. For instance, oral mucositis and gastrointestinal toxicities are commonly seen when patients are prescribed high doses of chemotherapy as it could be the case of certain induction regimens for AML or ALL; or conditioning regimens for autologous HCT (auto-HCT) or allo-HCT which may also involve radiotherapy, resulting in serious malnutrition. Nurses would generally be the first to become aware of such findings and alert the rest of the team to consult nutritionists to help incorporate enteral or parenteral strategies to optimize patient's nutritional status. Several studies have reported adverse outcomes and nurse burnout with higher patients-to-nurse ratios [16, 17]. A recently published meta-analytical study showed considerable risk of burnout, emotional exhaustion, and depersonalization in nursing professionals in oncology services [18].

Other Factors

Floor Design

Inpatient cancer units are designed to provide the safest and most efficient care for patients. Generally, the floor layout is designed to position nurses in close proximity to the patients' beds to be able to respond more promptly to patient's needs. A work station is located right outside the door or inside the room (Fig. 3.1). This design is meant to improve efficiency and reduce the time spent away from patient care. In some facilities, central monitors are available to display important vital signs, such as monitoring of heart rate and blood pressure in patients who may be receiving certain types of chemotherapies, biological or experimental therapies. Yet, applicability of this design in underdeveloped countries may be challenging due to financial limitations or due to lack of technology.

Fig. 3.1 Inpatient hospital room in a cancer floor, Mayo Clinic, Jacksonville, FL, USA. (Used with permission of Mayo Foundation for Medical Education and Research, all rights reserved)

Environmental

The complex inpatient cancer center environment demands special consideration to ensure a healthy indoor air quality to protect patients against hospital-acquired infections [19, 20]. Sources of air pollution within the hospital include chemicals and microbial air pollutants from various sources [21]. Properly designed systems and optimal operations are essential to control and mitigate potential sources of pollutants such as air filtration, differential pressure control, directional airflow control, and ultraviolet germicidal irradiation disinfection, among others [22].

Rooms

The majority of cancer centers in the United States would provide a private room to a cancer patient in need of inpatient care. Naturally, a private room would offer a more restful and healing environment. Nevertheless, a private room is a necessity for those patients who require contact or respiratory isolation. In the case of patients undergoing a HCT or CAR-T therapy, these procedures are better administered in the setting of a private hospital room owing to the high risk of serious infections in the setting of profound cytopenias and immune suppression. With the advent of electronic health records, nowadays rooms are equipped with a work station inside the room (Fig. 3.1) for both convenience and efficacy.

Positive Pressure Rooms

Positively pressurized rooms are generally considered the cleanest environments in a hospital. A room is pressurized so that it is positive with respect to adjacent areas. It is designed in such a way to protect severely immunocompromised patients from

possible airborne pathogens present in adjacent areas. Positively pressurized rooms also commonly use high-efficiency particulate air (HEPA) filters at the supply terminals to guarantee the highest air quality to the patient. These types of rooms are generally found in Blood and Marrow Transplant units.

Negative Pressure Rooms

Conversely, negatively pressurized rooms used for airborne infection isolation are engineered to prevent airborne microbial contaminants from flowing to other areas. These rooms are generally reserved for patients who develop infections like tuberculosis because the organism can spread in the air from the patient to members of the healthcare team. The room typically is served by a dedicated exhaust fan, and some facilities also use UV radiation for disinfecting purposes.

Discussion

We described the main components of an inpatient unit in a cancer center. The ultimate goal must be to provide a safe environment for cancer patients and to facilitate delivery of care in an efficient manner. As healthcare expenditure continues to rise, it is important to ensure long-term sustainability by minimizing as much as possible operating costs.

Despite all advances, there are continuous challenges pertaining to further improving safety in the inpatient cancer setting. These include, but are not limited to, prevention of falls, nosocomial infections, and medication errors. Establishing interdisciplinary working groups which involve all healthcare participants and incorporate new technologies would certainly prove essential to further improve the safety and quality of care for patients with cancer.

Conflicts of Interests The author discloses consultancy for Pharmacyclics and Daiichi Sankyo.

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