Chapter 5

The Infusion Center

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Introduction

Cancer remains a major public health problem worldwide. In the United States, cancer represents the second leading cause of death [1]. Availability of more effective supportive therapies, namely, new generation of antimicrobials, antiemetics, and hematopoietic growth factors, among others, coupled with emergence of novel antineoplastic agents, have facilitated administration of cancer treatments outside the hospital setting [2–4]. Moreover, a significant number of new targeted therapies for various cancers are more amenable to being offered in the outpatient infusion center setting owing to a better toxicity profile [5, 6]. Another factor driving increased utilization of infusion centers include a lower healthcare cost when compared to the inpatient hospital setting. For instance, receiving a cancer treatment in a hospital will definitely cost more than if it were administered in an infusion center for the same medication at the same dose and frequency. This is also the case for other supportive therapies.

Cancer treatments typically require multiple visits. The logistics can be exhausting for patients and their caregivers who are already under a lot of stress including physical, emotional, and financial strain, among others. There are times when visitors may be restricted at the discretion of nursing staff. Receiving a treatment in an infusion center is definitely more convenient than going to a hospital, considering the increased hassle and complexities associated with the latter. Infusion centers are purposely designed to provide a calm environment for people receiving chemotherapy and other types of infusions, hence resulting in an improved psychological well-being. Yet, presently the role of the infusion center transcends beyond

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antineoplastic treatment administration. Below, we highlight the main services provided by infusion centers.

Infusion Center Area

Generally, infusion areas comprise a mix of beds and recliner chairs which are assigned based on the needs of the patient and the type of treatment that they will be receiving. Other services include on-site cable television, computers, and Wi-Fi access. Also, with the advent of electronic health records the contemporary design of infusion center rooms incorporate a computer working station for added convenience and efficiency (Fig. 5.1). Infusion centers provide a multitude of services including but not limited to:

- (a) Administration of blood products
- (b) Intravenous biotherapies
- (c) Chemotherapies: intravenous or subcutaneous
- (d) Antimicrobial therapies
- (e) Intravenous fluid including electrolytes replacement
- (f) Other therapies
 - (i) Bisphosphonates or similar therapies for bone protection
 - (ii) Intravenous iron replacement therapy
- (g) Nurse educators and library resources

Infusion centers allow providers to help patients better manage and control their disease and associated symptoms by providing a continuity of care throughout their medical need. By enhancing continuity of care, it improves patient compliance.

Fig. 5.1 Outpatient infusion center, Mayo Clinic, Jacksonville, FL, USA. (Used with permission of Mayo Foundation for Medical Education and Research, all rights reserved)

Infusion centers, in academic hospitals and even community-based settings, which are actively participating in research, do offer experimental therapy(ies) which encompass new drugs, or use existing drugs prescribed in new ways or on new diseases, among others. All medical and nursing staff are generally trained in oncology and clinical trial patient care. Clinical lab facilities are usually present on-site for proper specimen management. Most clinical trials, particularly phase 1 and 2 studies would also require presence of advanced cardiovascular life support certified personnel and equipment; for example, a defibrillator on-site in case patients develop untoward side effects to experimental therapies being administered. Pharmacists are also available on-site for the purpose of preparing and compounding antineoplastic agents; and to help determine the possibility of drug–drug interactions or to closely monitor administration of experimental therapies as part of clinical trials.

Staff

The team in a cancer center infusion facility consists of medical oncologists/hematologists, advanced practice providers, and certified oncology nurses who are available to help support your treatment needs in a safe manner. Other services that are available according to specific patients' needs include:

- (a) Social workers
- (b) Case managers
- (c) Nutrition therapists/dietary counselors
- (d) Health and wellness counselors
- (e) Administrative staff to assist with insurance-related issues or referrals to other clinical services.

Other On-Site Services

Clinical labs: Presence of on-site clinical labs provides added convenience to the patient and allows administration of prescribed therapies in a more timely fashion. While the capabilities and level of sophistication varies among centers, these labs, at the minimum, should be able to offer a complete blood count with a differential and a comprehensive metabolic panel. In cancer centers that perform complex procedures like allogeneic hematopoietic cell transplantation (allo-HCT), these on-site labs may also have capabilities to measure blood titers of immune suppressants, among others.

Diagnostic imaging: In large cancer centers, patients are able to have basic diagnostic imaging in close proximity to the infusion center, generally within the same building. The level of complexity of diagnostic services provided varies among cen-

ters, but generally standard radiologic testing such as chest X-ray are generally readily available. It is important to keep in mind that there is no universal model for what diagnostic imaging services must be available in close proximity of an infusion center, and it would certainly depend on available financial resources and architectural design, among others.

Disease-specific support services: Owing to the different type of treatments offered at an infusion center, various support services are available. This includes but is not limited to physicians, nurses, and advanced practice providers specialized in various specialties such as infectious diseases, hematology, and medical oncology, among others. Also, for those patients receiving their first cycle of therapy, a lot of education about the potential side effect(s) of newly prescribed antineoplastic agents or potential drug–drug interactions are provided by nurses and/or specialized pharmacists. Disease-specific educational materials such as booklets are regularly available on-site to be shared with patients and caregivers.

Infusion Centers: Convenience and Potential Healthcare Cost Savings

Availability of infusion centers in the outpatient setting provides a smoother transition of care from the inpatient to the outpatient setting in patients who had completed induction antineoplastic therapies for diseases like acute myeloid leukemia, or complex procedures such as HCT, both autologous (auto-HCT) or allo-HCT, and other cellular therapies, namely, chimeric antigen receptor T (CAR T)-cell therapy in the hospital setting. Generally, patients who undergo these procedures are required to continue to be followed closely for few weeks in the case of auto-HCT and CAR T-cell therapy, or for longer time (typically, approx. 2–3 months) in allo-HCT recipients [7–9]. These patients are required to stay in the vicinity of the cancer center for close surveillance and needed clinical management. Among the clinical services provided to these patients include administration of intravenous fluids and electrolytes, antimicrobials, transfusion of blood products and certain antineoplastic therapies. Although there are no established standards for hours of operations, in some cases infusion centers provide extended hours and weekend day access.

The cost of health care is rising at an unsustainable rate in the United States, and it is expected to continue to rise because of population changes and the high cost of novel anti-cancer therapies, among other reasons [10, 11]. Availability of outpatient cancer infusion centers has the potential to reduce readmission rates to the inpatient hospital setting [12]. This is possible by providing services like transfusion of blood products, intravenous fluids, antimicrobials, and others, which traditionally need to be administered in the hospital. This results in a twofold benefit of not only

preventing readmissions to the hospital, which is a national policy priority, but also providing aforementioned services at a lower cost.

Remaining Challenges

Cancer care is complex both logistically and operationally. Financial aspects related to the practice of oncology could be challenging owing to the very expensive cost of cancer drugs and the need to secure prior authorizations from third-party payers for certain therapies. This requirement can be at times problematic and could potentially affect the overall delivery of efficient and timely care. Also, during the COVID-19 pandemic caused by SARS-CoV-2, individual patient's decision needed to be made which could have resulted in delaying administration of chemotherapy. This has certainly been a learning lesson, and different oncology societies have developed guidelines on cancer care which will certainly help being better prepared for similar future events [13, 14].

Discussion

We described the major components required for successful operation of a cancer infusion center. The ultimate goals of a successful infusion center are to offer a patient-centered experience that improves the overall quality of delivered care at a sustainable cost. Beyond comfort and convenience, infusion centers are helpful in providing continuity of care, adherence to prescribed therapies, and administration of supportive therapies whenever indicated. This could have a beneficial effect on reducing readmissions to the hospital and improve patient satisfaction.

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

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