Dosing Done Right: A Review of Common Chemotherapy Calculations

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The potential for medication error is great with chemotherapy agents because of their high toxicity profile, small therapeutic index, and numerous dose-limiting adverse effects. The oncology team involved with chemotherapy treatment planning and administration assumes an active role in preventing such events by obtaining and maintaining competency in dose calculations, having knowledge of dose-limiting toxicities, appropriate ordering of drug regimens, and participation in safety verification processes. This article will provide a review of evidence-based formulas and their rationale for use in dosing chemotherapy, case scenarios with practice calculations, and recommendations for safe verification of chemotherapy drug order accuracy.

Chemotherapy agents are identified as high-risk medications because the therapeutic range between maximum benefit and severe side effects is narrow and poses high potential for serious toxicities. Sound knowledge and competence in chemotherapy dosing, drug measurement, and math calculations are crucial to safely ordering and administering these medications to patients with cancer. Oncology health professionals, mainly physicians, nurses, and pharmacists, are required to demonstrate proficiency and participate in safe verification processes to ensure each patient receives the correct drug and dose. Chemotherapy agents (parenteral and oral) are listed by the Institute for Safe Medication Practices (2008) as high-alert medications because of their heightened risk of causing significant patient harm when they are used in error.

Formulas Used in Chemotherapy Dosing

A structured approach to determine chemotherapy/biotherapy dosing is warranted for best practice. Every effort should be made to reduce potential for error and improve accuracy at each step of the chemotherapy process to avoid adverse consequences. Safe efforts include structured processes for ordering the drug, independent checking of indications and dosing, and recording of diagnostic and laboratory values by physicians, nurses, and pharmacists. As advances in cancer care continue, chemotherapy regimens have become increasingly complex.

Personnel involved with the administration and management of patients receiving such treatment are pivotal as they develop and adhere to quality standards to prevent medication errors. One method by which the cancer care team can aim to prevent such an error is in the area of dose determination and calculation for chemotherapy.

Dose determination requires a methodic approach to reduce errors and increase the accuracy of chemotherapy orders. Anti-cancer drugs are characterized by a narrow therapeutic index and wide inter-individual variability (Gao, Klumpen, & Gurney, 2008). Many factors contribute to the dosing of chemotherapy, including the actual height and weight of the patient (instead of the stated height and weight), the type of dosing (mg, mg/kg, mg/m^2, and area under the concentration curve [AUC]), the pharmacokinetics of the chemotherapy agents, the patient's age and gender, and genotyping and phenotyping (Gao et al., 2008).

Body Surface Area

The concept of body surface area (BSA), which is equivalent to skin surface area, was based on studies performed at the beginning of the 20th century. This research established that the basal metabolic rate varied among various species as a function of a power less than 1 (–0.75) of weight, which approximately corresponds to the variation of BSA as a function of weight (Gao et al., 2008). BSA was originally calculated using a formula based on height and weight developed by DuBois and DuBois (1916) in a study involving nine people. In the early 1950s, this formula was introduced into clinical pharmacology to predict a safe starting dose in phase I clinical trials from preclinical animal toxicology data. This calculation was later adopted for dosing cytotoxic drugs with minimal validation (Pinkel,

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