

3 | Types of sterile dosage forms

Sterile dosage forms basically can be classified in three broad categories:

1. Conventional small volume injectables
2. Conventional large volume injectables
3. Modified release (depot) injectables

Small volume injectables (SVIs) by definition are products contained to deliver no more than 100 mL from the same container. Large volume injectables (LVIs) are products contained in volumes greater than 100 mL. Modified release or depot injectable drug delivery systems are typically SVI whose formulations are designed to deliver drugs by routes other than intravenous and in regimens less frequent than by conventional therapies.

SMALL VOLUME INJECTABLES

SVIs dosage forms include solutions, suspensions, emulsions, and solids (Fig. 3-1). The number of ready-to-use solution dosage forms far exceeds (perhaps 3–1) the number of the second most frequent type of dosage form, the lyophilized or powder-filled sterile solid dosage form. Suspensions, emulsions, and other dispersed systems are a distant third although with more advancement in sustained release (depot) technologies, suspension dosage forms are increasing in number. While not considered in this chapter, other sterile dosage forms include sterile ophthalmic ointments and gels and implantable depot devices.

Solutions

Solutions are ready-to-use products or can be liquid concentrates (aqueous only) subsequently diluted in a smaller container or within a suitable IV fluid. Solutions can be aqueous or nonaqueous. Aqueous solutions can be completely water based or water combined with a water-miscible organic cosolvent such as ethanol, polyethylene glycol, glycerin, or propylene glycol.

Nonaqueous solutions, also called oleaginous solutions, contain oils as the vehicle. Only oils of vegetable origin are acceptable for injectable products, the most common oils being soybean, sesame, and cottonseed (see chap. 8). Oily solutions must not be administered by the IV route.

Suspensions

Suspensions can be coarse (macro) (Fig. 3-1) or microsized (micro- or nanosuspension) solids dispersed in a suitable vehicle, either water or oil. Insulin, vaccines, and microsphere delivery systems are formulated and delivered as injectable suspensions. In fact, the suspension is the primary dosage form for insulin products (e.g., Neutral Protamine Hagedorn—NPH—and Lente products). Suspensions, unless the dispersed particles are nanoparticles, cannot be administered by the IV route. Chapter 9 is devoted to parenteral suspensions and other dispersed systems.

Emulsions

Emulsions are also dispersed systems combining an oil phase with an aqueous phase. If the oil phase is dispersed in the aqueous phase, the dosage form is called an oil-in-water emulsion. If the aqueous phase is dispersed in the oil phase, the dosage form is called a water-in-oil emulsion. Most, if not all, injectable emulsions are oil-in-water systems. Liposomes are emulsified spherical vesicles composed of a phospholipid bilayer with an aqueous inner phase. Drugs can be incorporated in either the lipid or aqueous phases, depending on solubility. Liposomes structurally are similar to biologic membranes and have high potential as delivery systems for genetic therapeutics. More coverage of liposomes will occur later in this chapter and in chapter 9.