SNM Gadgetry

Multipurpose Double-Barrel Syringe: An Aid in the Administration of Radiopharmaceuticals*

Sheldon J. Ashley

Flushing Hospital and Medical Center, Flushing, New York

A double-barrel syringe was constructed by recombining the component parts of two commercially available and disposable hypodermic syringes and needles. The unit was sterilized and was used to perform dual pharmaceutical injections with a single successful venipuncture. The syringe was found to be easier to handle and having fewer drawbacks than present iv delivery systems. Applications for three routine examinations are described.

Venipuncture, along with the intravenous administration of radiopharmaceuticals, is an intricate part of a nuclear medicine technologist's profession. Whether injections are made promptly by an experienced technologist or throughout the day by attending and house staff physicians, expedient technique is a necessity. The double-barrel syringe affords the flexibility of administering two individual injectable materials through a single successful venipuncture. This can be accomplished in rapid succession using any volumes desired.

Materials and Methods

The double-barrel syringe is constructed from a 3-ml Luer syringe (Becton-Dickinson, Ind., Rutherford, NJ) with an attached 22-gage 2½-in. (No. 220 monoject diamond point) hypodermic needle (Sherwood Ind., St. Louis, MO), a 5-ml Luer syringe with a mounted 18-gage 1½-in. short-bevel hypodermic needle (Becton-Dickinson, Ind.), and small quantities of Scotch Grip contact adhesive No. 1300. This type of adhesive compound was chosen because it does not pose any biologic hazards and can be sterilized along with the rest of the unit.

Assembly. Recombination of the component parts of the materials described is performed in the following manner. The piston section of the 5-ml syringe is removed from its cylinder; the rubber plunger tip is retained, but the rigid plastic arm is discarded (Fig. 1). The rubber plunger tip is held firmly and the 22-gage needle is pushed directly through its center so the needle tip extends out of the smooth seating surface of the plunger tip. A few drops of contact adhesive are put into the rear indentation of the plunger tip. The needle is then pushed all the way, so that its base seats securely in the plunger tip (Fig. 2).

The unit is set aside to dry for at least 6 hr. Once the cement is dry, the 22-gage needle and plunger tip are mounted on a 3-ml syringe, and this is then inserted into the barrel of the 5-ml syringe (Fig. 3). The inner 3-ml syringe and 22-gage needle now perform the dual functions of a 3-ml syringe and of a piston plunger assembly for the cylinder of the 5-ml syringe.

For reprints contact: S. J. Ashley, Dept. of Nuclear Medicine, Flushing Hospital and Medical Center, 45th Ave. and Parsons Blvd., Flushing, NY 11355.

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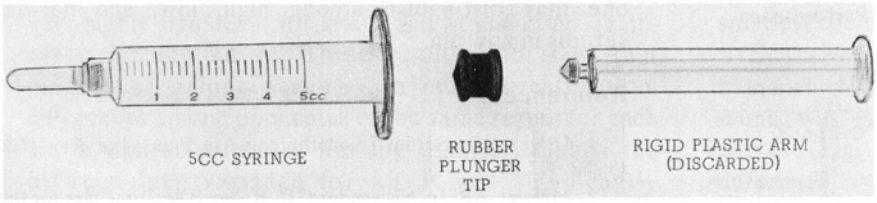

FIG. 1. Components of 5-ml syringe.

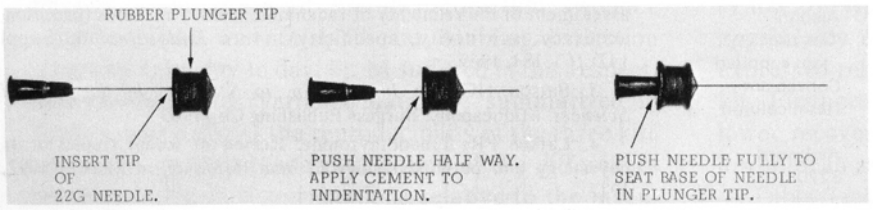

FIG. 2. Insertion and bonding of 22-gage needle to rubber plunger tip.

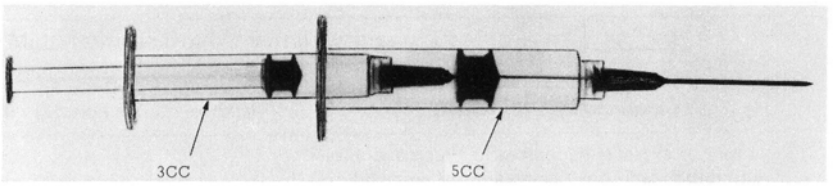

FIG. 3. Insertion of 3-ml syringe with 22-gage needle into barrel of 5-ml syringe.

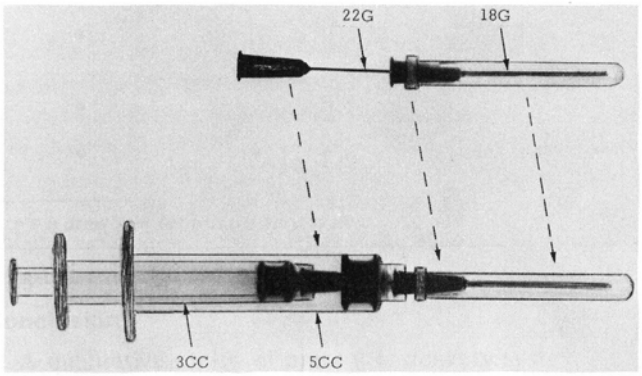

FIG. 4. Assembled double-barrel syringe, with the 22-gage needle within bore of 18-gage needle.

Each volumetric compartment is separate, yet communication to the vein is afforded through the hypodermic needles. The 22-gage needle fits within the bore of the 18-gage needle when all of the piston units of the assembled syringe are seated (Fig. 4). The final step is to sterilize the entire unit by radiation or gas. Once sterile, it is ready for use.

Combination of a 1-ml TB syringe with a 22-gage 2½-in. hypodermic needle and a 3-ml syringe with an 18-gage 1½-in. hypodermic needle can be used when smaller volumes for injection are desired.

Loading. Each syringe compartment must be loaded individually to its desired volume, following standard aseptic technique. The first to be loaded in each instance is the inner 3-ml syringe. Standard loading procedure always begins with all the piston-plunger assemblies seated and depressed.

Loading the 3-ml barrel:

1. Remove the 18-gage needle from the 5-ml syringe. This will expose 2 in. of the 22-gage needle through which access and loading of the 3-ml compartment is possible (Fig. 5A).
2. Using the exposed tip of the 22-gage needle and the standard plunger of the 3-ml syringe, load the 3-ml compartment to its desired volume (Fig. 5B).

Loading the 5-ml barrel:

1. Draw back on the barrel of the 3-ml syringe, which now acts as the piston assembly of the 5-ml syringe. This is done to retract the 22-gage needle into the barrel of the 5-ml syringe (Fig. 6A).
2. Replace the 18-gage needle onto the 5-ml syringe. When the barrel of the 3-ml syringe is depressed, the 22-gage needle will fit within the bore of the 18-gage needle (Fig. 6B).
3. The 5-ml syringe is loaded following aseptic technique by drawing back on the barrel of the 3-ml syringe, which now acts as the piston assembly of the outer syringe (Fig. 6C).

Note: In loading the double-barrel syringe, whichever material is to be injected first must be loaded in the 5-ml syringe, and the second material to be injected must be loaded in the 3-ml syringe.

Discharge. Both barrels are discharged rapidly following the described format.

Discharge of the 5-ml barrel: The 22-gage needle, plunger tip, and 3-ml syringe now act as one unit controlling the volumetric capacity of the outer 5-ml compartment. When the 3-ml syringe is pushed in, the rubber plunger tip moves forward, discharging the contents of the 5-ml compartment directly through the 18-gage needle (Fig. 7A).

Discharge of the 3-ml barrel: The inner barrel is discharged by pushing in on the piston of the 3-ml syringe. The injected material then passes through the 22-gage

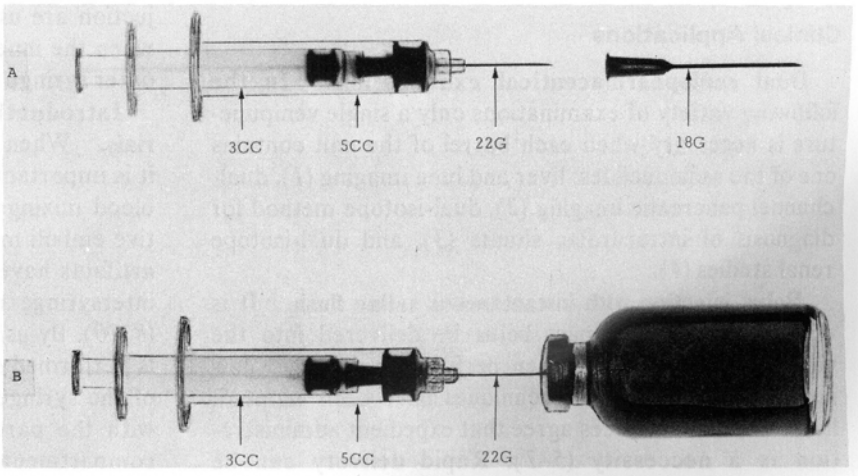

FIG. 5. Loading of 3-ml syringe.

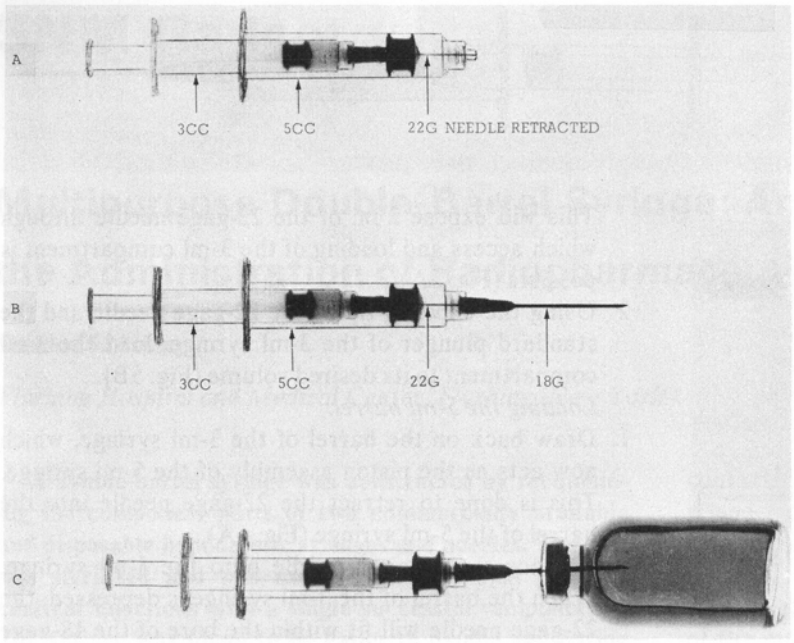

FIG. 6. Loading of 5-ml syringe.

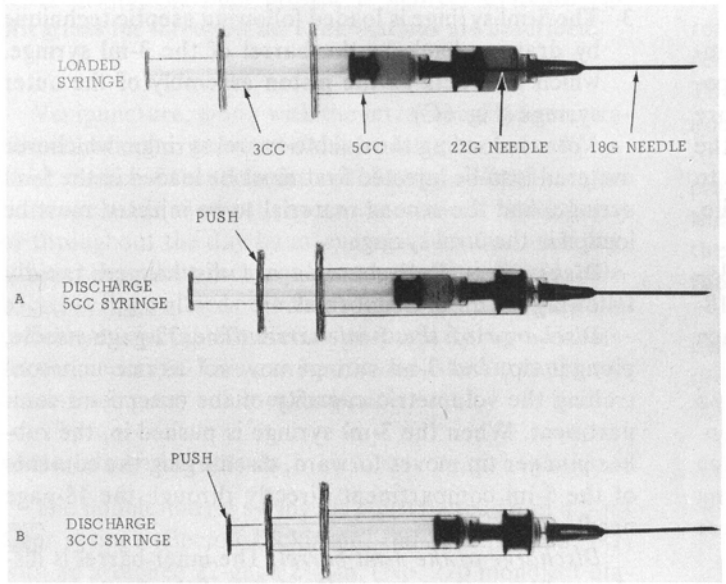

FIG. 7. Sequential discharge of syringe.

needle, to the 18-gage needle, and on into the lumen of the vein (Fig. 7B).

Clinical Applications

Dual radiopharmaceutical examinations. In the following variety of examinations only a single venipuncture is necessary when each barrel of the unit contains one of the radionuclides: liver and lung imaging (*1*), dual-channel pancreatic imaging (*2*), dual-isotope method for diagnosis of intracardiac shunts (*3*), and dual-isotope renal studies (*4*).

Bolus injection with instantaneous saline flush. It is essential that a compact bolus be delivered into the vascular compartment when performing dynamic flow studies. A spectrum of techniques have been adopted; however, all references agree that expedient administration is a neccessity (*5–7*). Rapid delivery can be facilitated when a bolus injection is immediately followed with a saline flush, especially when small volumes for injection are used. The double-barrel syringe can do this when the inner syringe contains the saline flush and the outer syringe the radiopharmaceutical of choice.

Introduction of macroaggregated lung materials. When performing lung perfusion imaging studies, it is important to make a clean injection with little or no blood mixing with the particulate material, or radioactive emboli may form in the syringe. A variety of image artifacts have been documented in the literature due to intersyringe mixing of blood and particulate material (*8–10*). By using the double-barrel syringe, venipuncture is performed so that blood enters only one compartment of the syringe and does not have an opportunity to mix with the particulate radiopharmaceutical in the other compartment.

TABLE 1. Multi-Purpose Double-Barrel Syringe

Common hypodermic syringe & needle	Start normal saline iv	Three-way stopcock	Butterfly infusion set	Double-barrel syringe	Delivery system drawbacks
•		•	•		Residual amount of radionuclide left in syringe
	•	•	•		Cumbersome for one person and time consuming
	•	•	•		Positive force of injection can cause needle to pop out of skin or tubing to disconnect
•					Blood can mix in syringe when introducing lung imaging material
			•		Leak possible when changing syringes on tubing
•					More than one venipuncture needed in dual radionuclide studies
•	•		•		No bolus or bolus flush available without time delay in flow studies

• = *a drawback for this delivery system.*

Conclusions

A qualitative review of present iv delivery systems is presented in Table 1. When compared to alternative methods, such as starting a normal saline iv, using a butterfly infusion set, maneuvering a three-way stopcock, or using a standard hypodermic syringe and needle, the double-barrel syringe is easier to handle and has fewer disadvantages.

When considering that patient risk and discomfort can be minimized, and that radiation exposure due to repeat examinations can be reduced, the attributes of this iv delivery system should be evaluated and may prove to be an aid in your laboratory.

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