A new type of handheld power syringe for cardiovascular angiography

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Contrast angiography is an integral part of cardiovascular disease diagnosis. In 1994, US cardiologists performed >1.8 million diagnostic angiographic procedures (1). Radiologists and vascular surgeons also perform these procedures in many hospitals.

The delivery of contrast material can be done either manually with a syringe or mechanically with a power injector. Traditionally, hand-injected techniques using 10-mL syringes have been limited by a lack of adequate power and volume. Limitations in power and volume have resulted in suboptimal imaging during the following procedures:

- diagnostic coronary angiography using 5F and 6F catheters, particularly in patients with high coronary resistance or flows (e.g., patients with hypertension, left ventricular hypertrophy, aortic regurgitation);
- angiography of the iliac and femoral vessels;
- aortography;
- ventriculography;
- percutaneous transluminal coronary angiography using 6F or 7F guiding catheters; and
- coronary interventions using bulky devices (e.g., rotational atherectomy with large burrs, directional atherectomy, excimer laser angioplasty, and others).

Larger syringes require power in excess of manual capabilities. Therefore, when larger volumes or greater power is needed, a mechanical power injector is used. The use of a mechanical power injector, while essential in many settings, is sometimes cumbersome and impractical. For instance, an assistant is needed to set up the nonsterile device on a sterile field. Once connected to the catheter, hemodynamic monitoring is temporarily suspended. Some wastage of contrast material is inevitable, and reloading (should additional injections become necessary) is inconvenient. Most notable, however, is the lack of physician control over contrast material delivery once the injection sequence has begun.

Mechanical power injectors have been used in place of manual 10-mL syringes during routine coronary angiography as well as during coronary angioplasty when imaging is hampered by interventional devices within the guide catheter (2, 3). This, however, still does not eliminate the problems of sterility, the need for an assistant, and the lack of control once the injection has been activated. A modified hand injector used for coronary visualization during angioplasty was developed by Weiner et al (4), but the device was limited by a small (4 mL) maximal capacity for a given injection, and the device was not further developed.
A new hand-operated, mechanically advantaged, disposable syringe (OZ Power Syringe, Cardiovascular Innovations, Athens, Tex.) (Figure 1) has been developed. This patented and Food and Drug Administration-approved device offers an additional tool to perform various angiographic procedures (Figures 2-4). These procedures include diagnostic coronary angiography using 5F and 6F catheter systems. Coronary interventions using small (6F) guide catheters is becoming popular (both by radial and femoral approaches), and more coronary interventions using bulky devices (e.g., directional coronary atherectomy, high-speed rotational atherectomy) are being performed. The OZ Power Syringe becomes useful in all of these situations by providing a greater degree of power for injection. Its other main applications, such as peripheral vascular imaging and interventions, aortography (especially infrarenal aortography), and ventriculography, use its ability to deliver larger volumes of contrast at greater pressures than possible with the manual syringe. The OZ Power Syringe is useful in other procedures, such as intraoperative vascular imaging, saline delivery during excimer laser coronary angioplasty, and inflation of valvuloplasty balloons.

This sterile, disposable power syringe provides physicians with total control of angiography while enhancing their manual power several fold. The use of a lever system to drive the plunger into the syringe barrel, along with the ability to use the entire palm to grip the handle, enables the operator to generate much greater degrees of pressure. Physicians can control the exact delivery of contrast, 1 to 32 mL, while visualizing the image fluoroscopically. Excellent quality images can be obtained using a reduced volume of contrast material. Additionally, by diluting the contrast with saline (25% to 50%), the operator can further reduce the quantity of contrast material while reducing the patient's heat and pain sensations.

During interventional cardiac procedures, the extra power provided allows the use of smaller-sized catheters for the radial or femoral arterial approaches (Figure 5). The smaller catheters and reduced quantity of contrast material improve patient comfort, allow for early ambulation, reduce renal toxicity, and decrease cost.

In the surgical suite, the mechanical power injector is limited in use, cumbersome, and nonsterile. The new power syringe provides improved imaging capabilities for large-vessel angiography and greatly enhances the visualization necessary for the new procedure of stent-graft placement (Figure 6).

Thus, the power syringe is a complementary tool for the cardiovascular physician to enhance imaging capabilities and improve patient outcomes. Prospective studies are being designed to compare this device with previously available injectors.

Note: Dr. Anwar is a major stockholder in Cardiovascular Innovations, the manufacturer of the OZ Power Syringe.—Ed
References

Figure 1

Figure 2

Figure 3

Figure 4