ABSTRACT: This article describes the new technological advancements of portal systems. Implantable port devices provide intravenous access for chemotherapy administration, medication infusions, and have been approved by the Food and Drug Administration (FDA) for use in radiologic and diagnostic power injection studies. Development of the power injectable portal systems, device use, accessing and de-accessing, scope of practice, and pinch off syndrome are discussed. (J Radiol Nurs 2009;28:27-31.)

KEYWORDS: Portal system; Pinch off syndrome; Access and de-access.

WHAT ARE PORTAL SYSTEMS?
Portal systems, also known as “ports,” are implantable devices that are surgically inserted into a vein using a local anesthetic and moderate sedation. The system consists of a portal with one or two self-sealing silicone septa and a single or dual lumen catheter made of either silicone or polyurethane. The system is completely implantable and the portal sits subcutaneously in the patient’s chest wall or arm. The tip of the catheter is located close to the right atrium in the superior vena cava (Morris, Jaques, & Mauro, 1992).

Treatment using portal systems can decrease the number of needle sticks a patient has to undergo and can help avoid the potential discomfort and risk that can be associated with intravenous chemotherapy treatment (Breastcancer.org, 2008). These devices can also be beneficial for patients who require ongoing intravenous medication or blood product administration, total parenteral nutrition (TPN) for a long term, frequent blood draws, and individuals who may have the potential to run out of usable vein sites due to frequent need for vein access (Tirgan.com, 2008).

THE DEVELOPMENT OF POWER INJECTABLE DEVICES
Power injectable portal systems were first introduced to the health care community in mid-2006 and are the future for implantable venous access devices. These systems allow for contrast material to be injected at a higher rate than hand injection into the blood stream resulting in a more accurate, detailed image of the area being scanned during a computed tomography (CT) or magnetic resonance imaging (MRI) study (BARD Access Systems CT Guide, 2007a).

The PowerPort® Implanted Port System, developed by BARD Access Systems based at Salt Lake City, Utah, received FDA approval as the world’s first power injectable access device in 2006 (Figure 1). In 2007, BARD expanded its product line with the PowerPort M.R.I. implantable portal system. This newly constructed port is made out of Delrin Theroplastic, which is lighter in weight than titanium for patient comfort and creates less artifact during scans (BARD Access Systems Nurses Guide, 2007b).

In June 2007, Smiths Medical MD, Inc. based at St. Paul, Minnesota, announced the FDA clearance for seven of their power injectable implantable access systems including the PORT-A-CATH®, and PORT-A CATH II® POWER P.A.C. Implantable Access System (Figure 2). Also announced was a new line of power injectable Huber needles, the GRIPPER PLUS® POWER P.A.C. Safety Huber Needle (Servais, 2007). Three more configurations, including the P.A.S. PORT® peripheral venous access system that can be placed in the patient’s chest or arm, were introduced to the market in January 2008 (Servais, 2007).
Both the PORT-A-CATH® and PowerPort® systems are MRI compatible for studies with a static magnetic field of 3 Tesla or less, spatial gradient field of 330 Gauss/cm or less (BARD Access Systems CT Guide, 2007a). The provider should verify manufacturer’s recommendations before use.

HOW ARE PORTAL SYSTEMS ACCESSED?

Ports are accessed with a special noncoring needle called a Huber needle under sterile technique. This needle pushes through the skin and into the silicone septum of the port. This process is usually not painful to the patient but they may feel pressure or pushing as the needle is advanced to access the system (Cancerbackup.org, 2007). To conduct power injection studies through the portal system, the port must meet power injection specifications and should be accessed with a Huber needle specifically designed for power injection studies. To ensure that the port is properly accessed, attach a 10-ml syringe with normal saline and check for blood return. When blood return is verified, vigorously inject saline through the line to ensure patency, and then flush the catheter for use (BARD Access Systems Nurses Guide, 2007b). Failure to ensure port patency can lead to port system failure (BARD Access Systems Nurses Guide, 2007b). If resistance is met while attempting to flush the catheter to verify patency, try to aspirate from the device. If difficulties with flow persist, do not continue use of the port. A blood clot or fibrin formation may be present in the catheter or the catheter may be dislodged from its correct position. The radiologist or primary physician should be notified. Peripheral access may need to be obtained to complete the study.

Always instruct the patient to notify the health care professional if he or she feels pain during injection of any solution into the port or if any signs of extravasation are present. Injection should be stopped immediately to prevent or minimize patient injury.

SCOPE OF PRACTICE FOR ACCESSING PORTS

It is important that only trained individuals access subcutaneous port devices to minimize the potential risk of serious complications including but not limited to air embolism, bleeding, catheter occlusion, catheter embolism, extravasation, fibrin sheath formation, and catheter or port-related sepsis (BARD Access Systems Nurses Guide, 2007b).

The American Society for Radiological Technologists (ASRT) (2007) state in their Practice Standards for Medical Imaging, “ASRT advocates that accessing existing peripheral or central vascular implanted devices or external access lines to administer contrast media, radiopharmaceuticals and medications or maintaining line patency is within the scope of practice for radiological technologists with appropriate clinical and didactic education and where federal and state law and/or institutional policy permit.”¹

Standards for accessing implanted port devices vary from state to state. Each institution should have a policy in place that addresses accessing ports, utilization of portal systems, and de-accessing protocol.

ACCESSING DEVICES FOR POWER INJECTION STUDIES

The BARD PowerPort® and PowerPort M.R.I.® should be accessed with a PowerLoc® Safety Infusion Set (Figure 3). This kit comes with a 19-gauge (cream colored), 20-gauge (yellow colored), or 22-gauge (black colored) PowerLoc® Safety Huber Needle and Implanted Port

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Compatible Callout Tag. The Callout Tag allows for easy identification of maximum psi of 300, maximum flow rate of 5 ml/s, and verification that the implanted device is a PowerPort® and can be used for power injection (BARD Access Systems CT Guide, 2007a). Additionally, there is an optional Y-site connector available for use with the 19, 20, and 22 gauge accessing devices (BARD Access Systems CT Guide, 2007a).

The GRIPPER PLUS® POWER P.A.C. Huber Needle accessing device was developed by Smiths Medical, Inc. for use with their new product line of power injectable ports (Figure 4). This specialized Huber needle can easily be identified by its distinct blue tubing and allows for a higher pressure flow rate than the standard accessing device (Servais, 2007). For safety, each access device has a printed clamp that shows power injection specifications. The maximum power injection infusion rate is 5 ml/second which is the same maximum infusion rate for a 19 and 20 gauge IV placement (Lin, 2007).

It is recommended that the accessing device used at the time of study is specifically labeled for use with the implanted port device. Failure to use a compatible system can result in damage to the device and possible injury to the patient (BARD Access Systems Nurses Guide, 2007b).

PINCH OFF SYNDROME

Pinch off syndrome can occur in up to 1% of all central venous catheter placements (Dorner et al., 2003). Implanted portal systems that are placed in the subclavian vein may become obstructed or pinched off by thrombosis, compression of the catheter between the clavicle and rib, or impinged against the vessel wall causing an occlusion and rendering the implanted device unusable (Dorner et al., 2003). The concept of pinch off is often demonstrated with the inability to aspirate from the port once it is accessed. The obstruction or catheter narrowing can often be relieved by changing the position of the patient’s shoulder. Pinch off can be an initial sign that the catheter is susceptible to subsequent fracture and embolization (Dorner et al., 2003). Most manufacturers recommend implantation of port devices in vessels that reduce the risk of pinch off. It is extremely important for the health care provider to verify patency of the catheter once the port is accessed, before performing a power injection study. Patency can be verified with checking for adequate free-flowing blood return, then flushing the catheter with sterile saline before use.

Figure 3. PowerLoc* Safety Infusion Set. (Provided courtesy of BARD Access Systems © Copyright 2007 C. R. Brad, Inc.)

Figure 4. GRIPPER PLUS® POWER P.A.C. Huber Needle accessing device. (Provided courtesy of Smiths Medical MD, Inc. © Copyright 2007.)
DE-ACCESSING THE PORTAL SYSTEM?

Before de-accessing a portal system device, on initial placement and after each use, the port and catheter should be flushed with 10 to 20 ml of sterile saline, then 5 ml of 100 units/ml of heparinized saline or per institutional protocol to reduce the risk of blood clot formation (Morris et al., 1992). The clamp on the accessing device should be closed during the injection of the last 0.5 ml of solution, positive pressure technique, to minimize blood backflow into the tip of the catheter, which can cause clots formation (BARD Access Systems Nurses Guide, 2007b).

Both the GRIPPER PLUS®/C210 POWER P.A.C. and the PowerLoc®/C210 Safety Infusion Set have a safety needle that pulls straight out when de-accessing the port and clicks into a safety lock position to reduce health care provider’s exposure to accidental needle sticks and bloodborne pathogens (Lin, 2007).

HOW WILL YOU KNOW IF A PATIENT’S PORT IS POWER INJECTABLE?

Patients are given two identification cards to carry in their wallet, plus a key ring identification card at the time of port placement. All three cards carry the specific information on portal serial number, implantation date and physician, as well as power injection specifications. In addition, the PowerPort® and PowerPort M.R.I.® have three palpation points comprising silicone in the septum of the catheter arranged in triangular formation, and a radiopaque power symbol identifier that can be seen under X-ray or fluoroscopy guidance (Figure 5). The PowerPort M.R.I.® has a unique “CT” symbol implanted in the radiopaque identifier that can aid in the identification of a flipped port (BARD Access Systems CT Guide, 2007a).

These items act as verification tools to health care providers that the patient has an implanted power injectable port. Also included in the port package are several medical record stickers with patient and device information for medical record documentation.

Implementation

The placement and use of power injectable portal systems at the Minneapolis VA Medical Center has been a great success. The patients are thankful that they do not have to endure another needle stick and IV placement for contrast-enhanced studies to be performed. This new technology is allowing health care workers to provide more efficient and safer care to patients without compromising patient comfort. Power Injectable Portal Systems are fast becoming the gold standard for implantable venous access devices.

References


