Journal of Radiology Nursing 38 (2019) 131–133

Contents lists available at ScienceDirect

Journal of Radiology Nursing

journal homepage: www.sciencedirect.com/journal/journal-of-radiology-nursing

Improving Identification of Power Ports Using Computed Tomography Scouts

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Keywords:
Power port
Computed tomography
Contrast injection

A B S T R A C T

Chest radiographs provide the best means of visualizing radiographic markings imprinted on power ports. Computed tomography scouts can also confirm many of these features, but consideration must be given to kilovoltage peak, milliamp, scout length, and patient positioning. Failure to properly identify power ports can lead to device failure, harm to the patient, or unnecessary venipunctures.

Background

With the advent of implantable ports came the ability to easily draw blood and administer intravenous solutions to patients. These devices are placed with relative ease, may be used immediately upon implantation, and have the potential for long-term viability compared with other vascular access devices (Chopra, 2018). Limitations to early non–power injectable ports, in part, included the inability to use them for power injection of contrast media during computed tomography (CT) scans. This became a crucial need for any vascular access device as protocols are increasingly reliant on specific timing requirements and delivery rates for contrast boluses. Manufacturers of power ports sought to meet this need and further reduce the need for venipunctures.

Power ports aid in safe and reliable delivery of contrast media during many CT studies. Manufacturers may include an identification card, key fob, and bracelet in their kits. A procedural report, which includes the type of implanted device, can also be provided. The ability to readily identify a power port may be difficult if the port is placed at an outside facility or if a patient forgets, loses, or fails to receive these items.

To aid identification, many power ports have a radiopaque marking on the device. If a radiograph of the device is not available, CT can also be used to aid in device identification. This radiopaque marking generally includes an imprint on the device using the letters CT. Depending on the manufacturer, this marking can be located on different areas of the device (Figure 1).

CT scouts for power port identification

A review of the literature using PubMed and Clinical Key database was conducted. Port, port scout, port identification, and CT scout were each used to query the database. No findings on how to adjust kilovoltage peak (KvP) and milliamp (mA) for CT scouts for optimal visualization of power port identifiers resulted from these searches (Figures 2 and 3).

The inability to accurately identify power ports' radiopaque markings using a CT scout can be due to various reasons. One problem is the use of a high KvP, which results in overpenetration by the radiation beam through the device. Images will have poorer contrast with a higher KvP. This reduces visualization of the device identifiers. Reducing the KvP to around 80 for most scanners is generally sufficient in reducing overpenetration of the device.

In addition, CT scouts using a low mA also result in grainy images. This leads to the inability to clearly identify identification markings on the power port. Setting the mA to around 100 for most scanners is generally appropriate. Figures 4 and 5 compare KvP and mA parameters on the same patient. A setting of lower KvP and higher mA provides an optimal view of this power port's identifiers (i.e., triangular shape and imprinted CT letters in this particular case). Notice that the attached catheter position also demonstrates improved visualization using the lower KvP and higher mA.

The length of the scout also affects the ability to identify a port as power injectable. Attempting to obtain a clear image for port identification from a long scout creates a grainy image when

The authors have no disclosures or conflicts of interest relevant to this manuscript.
Prior Presentation/Publication: no.
External Funding: none.

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https://doi.org/10.1016/j.jradnu.2018.12.008
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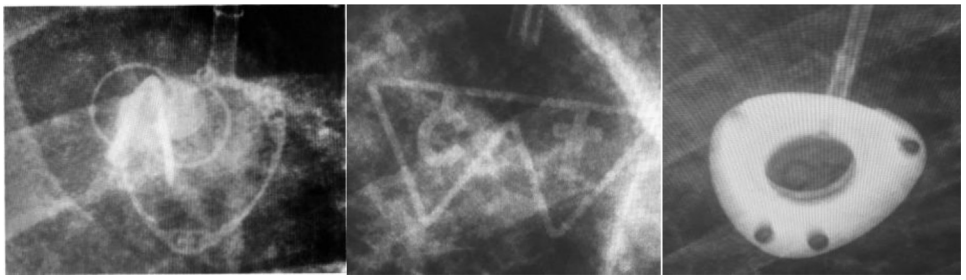

Figure 1. Some power port identifiers include triangular shape and/or the letters CT.

KvP refers to the voltage applied to the x-ray tube which determines the energy (acceleration) of the released photons.

Figure 2. Definition of KvP.

mA refers to the number of potential photons being emitted by the x-ray tube towards the receiver.

Figure 3. Definition of mA

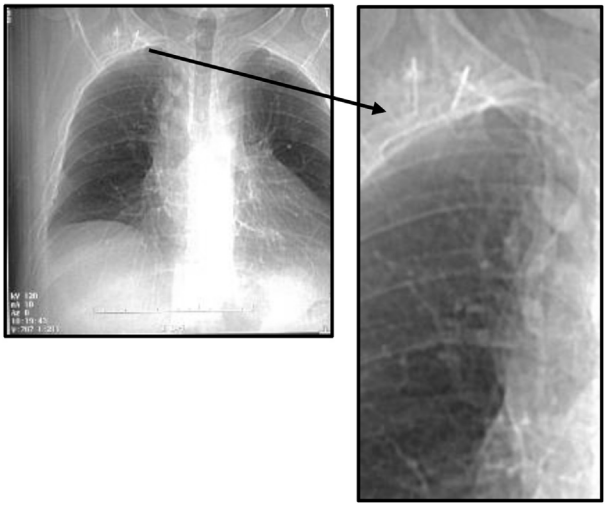

Figure 4. CT scout of power port using KvP 120 and mA 10. CT = computed tomography; KvP = kilovoltage peak; mA = milliamp.

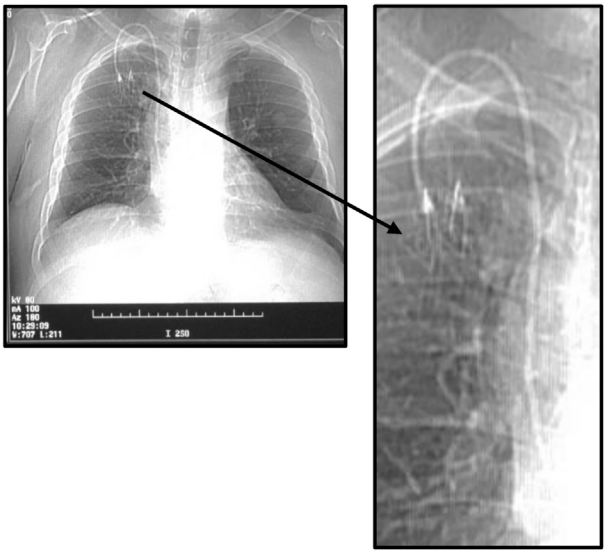

Figure 5. CT scout of power port using KvP 80 and mA 100. CT = computed tomography; KvP = kilovoltage peak; mA = milliamp.

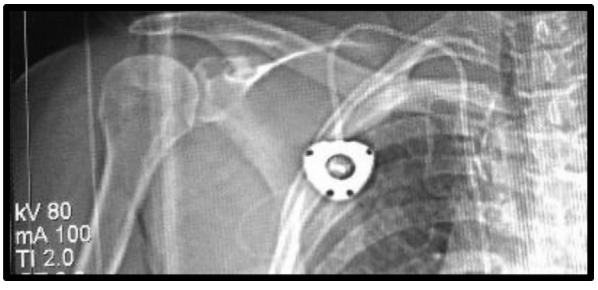

Figure 6. Power port using 80 KvP and 100 mA. KvP = kilovoltage peak; mA = milliamp.

magnification is required. Consider limiting the scout length to an area that demonstrates the type and position of the device.

CT scouts can present some imaging challenges to port identification. CT scouts should provide an anterior-posterior view of the device to allow full visualization of the port's identification features. This is especially important for ports that use identifying letters. Ports are generally placed in the chest but may be implanted in an upper or lower extremity or abdomen based on a variety of radiologist or patient considerations (Chopra, 2018).

Finally, even if the port is secure, it may "flip" or rotate out of position, kinking the tubing and preventing visualization. It is

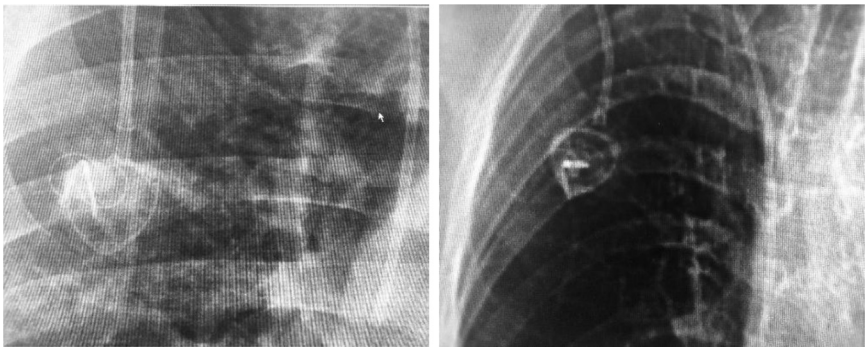

Figure 7. CXR of the power port with imprinted letters CT on the left side compared with the CT scout of a similar device on the right side. CT = computed tomography; CXR = chest x-ray.

important to position patients to facilitate a full frontal view of the device. For ports placed in the upper chest, it is particularly helpful to have arms down by the patient's side when obtaining a scout.

Additional considerations

Identification of power ports using other characteristics such as morphology or a radiopaque feature, as shown in Figure 6, may not be as adversely effected as identifying the imprinted CT marking on a device by the scanning techniques. However, visualization of the device will be greatly enhanced by using a scout that follows the previously mentioned considerations when no other identifiers are available.

Devices with smaller imprinted letters may be difficult to visualize using a CT scout due to the limited pixels (Figure 7). Although a CT scan can improve the ability to see these imprints clearly, it will require higher doses of radiation than a standard chest radiograph. If identification with a CT scout proves unsuccessful, a chest radiograph can be considered in the absence of other identification features. Identification should always follow department and manufacturer recommendations. Some manufacturers suggest ensuring at least two identifiers are verified before using a power port for power injections. When possible, charts should maintain a permanent record detailing the specific power port identifiers used, insertion date, and institution where it was implanted. That way, the process does not need to be repeated for the same device on subsequent encounters.

Implications for practice

Failure to properly identify power injectability of a port can be very dangerous and should preclude its use for power injections. Damage to the device or harm to the patient can be a real risk if the device is not used according to the manufacturer's recommendations. Damage might include device rupture and fragment embolization (Smith, 2008). This failure can be overcome in part by developing a specific protocol for port identification when patients present with no other identifiers and a radiograph of the device is not available. Protocols can also limit the need to reimage due to inadequate scouts, reducing unnecessary radiation exposure.

With improved identification of power ports, less venipunctures are required. This should make for safer injections and increase the timeliness of care. These have the potential to improve the quality of care and provide an overall better experience for patients.

Summary

Power ports should be properly identified before being used for power injections. When used according to specific manufacturer's guidelines, the risk of damage to the device or harm to the patient is greatly reduced. Chest radiographs remain the standard procedure for confirmation of power port features located on the device. When using a CT scout to visualize a radiopaque CT marking, it is necessary to use a lower KvP and higher mA; limit the scout length to include only the device area; and position the patient to allow a frontal view of the port. This should allow accurate and timely identification of the device, reduce delays in care, and ensure a better patient care experience.

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