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Original Article

# Application of an ultrasound-guided low-approach insertion technique in three types of totally implantable access port

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**Abstract**

*Background*: Totally implantable access ports (TIAPs) are alternatives to central venous catheters for patients requiring chemotherapy. Since January 2003, we have used a central approach two-point incision technique to insert TIAPs. Following advances in ultrasound technique and clinical experience for tunneled dialysis catheter placement, we modified the central approach to a low-approach technique.

*Methods*: From January 2009 to June 2010, patients consulted for TIAP insertion in our department were enrolled in our study. Different brands and materials of central venous catheters of TIAPs were inserted by the low-approach two-point incision technique (Phase I) or the low-approach one-point incision technique (Phase II). The insertion time, failure rate, procedural and late complications, degree of satisfaction, and cosmetic scores were recorded.

*Results*: Ninety-seven patients and 107 patients were implanted via the two-point and one-point low-approach techniques, respectively, with different kinds of TIAP. No matter which type of TIAP was used, the success rate in both phases was 100% without procedural complications using the low-approach technique. The average time for device insertion was 30 minutes for the two-point incision technique used during Phase I and 26–28 minutes for the one-point incision technique used during Phase II. Satisfaction and cosmetic scores were high.

*Conclusion*: Our study highlights a revised technique for placement of TIAP systems of differing types of material or size. Not only was the curvature of the device catheter smooth, but patients were satisfied with the cosmetic appearance.



*Keywords:* catheterization; central venous catheter; jugular vein; totally implantable access port; ultrasound

## 1. Introduction

Central venous catheters are frequently used for chemotherapy delivery in oncological patients. For patients requiring frequent intravenous access, insertion of implanted central venous catheters such as totally implantable access ports (TIAPs) is usually performed.

Beginning January 2003, we used a modified two-point incision percutaneous placement technique to insert TIAPs.[1] We found that the technique was as effective as the traditional venous cutdown technique. The anatomical landmark technique was used for venipuncture of the right internal jugular vein (RIJV) because of lack of assistance from an ultrasound device at that time.[1] The central approach (paracricoid approach) was used to avoid major complications.[2–5] To ensure a smooth curvature and prevent kinking of the catheter over the neck, we invented the two-point incision percutaneous placement technique.[1]

Remarkable advancement of our technique came after the introduction of ultrasound in our department. The real-time

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ultrasound-guided technique was used to perform venipuncture for vascular access.[6–12] With the assistance of real-time ultrasound guidance, we were able to perform low-approach venipuncture safely.

At first, we applied this ultrasound guidance technique for tunneled dialysis catheter (TDC) insertion.[6] We also found that by using low-approach venipuncture of the RIJV and a 1 cm transverse incision wound lateral to the venipuncture site, we could create a more smooth curvature of the subcutaneous tunnel than that which resulted from the central approach.[1,6] In recent years, we changed the venipuncture site from the central approach to an ultrasound-guided low approach for TIAP insertion. Initially, a two-point incision technique was used to create a subcutaneous tunnel from the port pocket to the venipuncture site. Subsequently, we modified the technique to a single small incision and tunneling technique. Furthermore, there are TIAPs of different brands, catheter materials, and diameters, and the material and size of the catheter of the TIAP system may affect the curvature of the device catheter and the success rate of insertion. Therefore, we designed this study to evaluate whether the ultrasound-guided one-incision low-approach technique could be applied for TIAP insertion.

## 2. Methods

### 2.1. Patients

From January 2009 to June 2010, our department was consulted regarding 214 patients requiring TIAP insertion. In the preprocedure visit, we performed a bedside ultrasound over the neck region to exclude those with thrombotic and stenotic RIJVs. We excluded from this study patients with thrombotic and stenotic RIJVs, local infection or pathology over the intended venipuncture or incision site, a potential risk of compromised airway, and abnormalities in image studies, such as a huge mediastinal tumor seen on chest radiography or compression of the superior vena cava by a tumor mass seen on chest computed tomography.

Informed consent was obtained from every patient and/or the patient's family who agreed to TIAP placement via the RIJV. Potential adverse events were explained in detail during the preprocedure visit. For each patient, routine preprocedure laboratory examinations included prothrombin time/activated partial thromboplastin time and complete blood count. Blood products were transfused to ensure that the prothrombin time international normalized ratio was smaller than 1.2 and the platelet count was greater than 70,000/mL.

### 2.2. General technique and catheter selection: Preprocedure preparation

The same two anesthesiologists (P.T.C. and H.W.C.) were responsible for all TIAP insertions. The study participants, most of whom were inpatients at the time of their procedures, underwent TIAP insertion in the anesthesia induction room. Standard preparation, monitoring and anesthesia were performed.[1] Induction of intravenous general anesthesia was usually done with alfentanyl 200–400 μg and midazolam 1–2 mg after skin sterilization.

#### 2.2.1. Phase I low-approach two-point incision technique

The Arrow Implantable Vascular Access System (Arrow International Inc., Mount Holly, NJ, USA) was used for placement from January 2009 to August 2009.

Briefly, the procedure was as follows: First, the finding needle was slowly advanced from the intended skin puncture site (point 1, usually 1–1.5 cm above the clavicle) to above the RIJV under real-time ultrasound guidance, and 1–2 mL of 1% lidocaine was injected over the skin puncture site and this tract (Fig. 1). Ultrasound-guided venipuncture was then performed using an 18-gauge hollow needle. Once the vein was revealed, the hollow needle was removed after a guidewire was inserted through it.

Second, 1% lidocaine was injected over the intended tunnel tract and implantation site. A transverse incision 0.5 cm in length (point 1) was made and dissected next to the skin puncture site. Then, a skin incision 0.5 cm in length (point 2) was made 3–4 cm lateral to the skin puncture site (Fig. 1). Third, a subcutaneous pocket was created using the right deltopectoral groove approach with a 3–4 cm transverse skin incision, which was then dissected above the fascia of the pectoralis muscle to fix the TIAP *in situ*. Fourth, a subcutaneous tunnel was created from the port pocket using a tunneler over the clavicle, with the catheter mounted to its rear end, directed toward point 2 and later pulled out from point 2 along with the tunneler. Fifth, another tunnel between point 1 and point 2 was created using a mosquito from point 1 toward

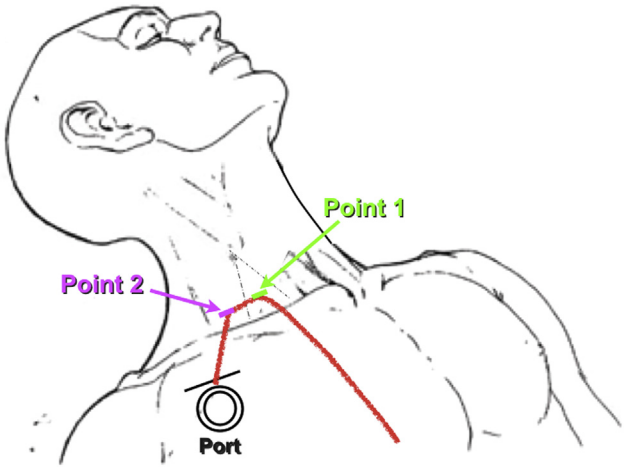


Fig. 1. Low-approach two-point incision technique. Ultrasound-guided venipuncture was performed on point 1 (0.5 cm in length, usually 1–1.5 cm above the clavicle). Then, a skin incision 0.5 cm in length (point 2) was made 3–4 cm lateral to point 1. A subcutaneous pocket was then created using the right deltopectoral groove approach with a 3–4 cm transverse skin incision. A subcutaneous tunnel was created from the port pocket using a tunneler over the clavicle, directed toward point 2 and later pulled out from point 2 along with the tunneler. Another tunnel between point 1 and point 2 was created using a mosquito from point 1 towards point 2, and the catheter was then pulled from point 2 to point 1.