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PRS GLOBAL OPEN

ORIGINAL ARTICLE

Hand/Peripheral Nerve

Intravenous Access in Infants Undergoing Bilateral Sural Nerve Grafts for Primary Brachial Plexus Exploration

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Background: Intravenous access (IVA) in infants undergoing primary brachial plexus exploration may be difficult. Both lower limbs are prepared and draped for sural nerve graft harvesting. The injured upper limb is also prepared and draped and is not available for IVA. In difficult IVA from the remaining upper limb, we have been using one of the feet for IVA. The infection rate and problems of intravenous infusions in this setting have never been studied in the literature. This study documents the infection rate and problems of intravenous infusions in these infants when a foot (within the sterile field) is used for IVA.

Methods: This is a retrospective study of 63 consecutive infants undergoing primary brachial plexus exploration, and in whom IVA was obtained from one of the feet. Infection rate and problems of intravenous infusions were recorded.

Results: No surgical wound infection and no infection of the IVA site were noted. There were no instances of accidental dislodgement of the intravenous cannula and no instances of extravasation.

Conclusion: The use of one of the feet (within the sterile filed) for IVA is safe and acceptable in infants undergoing primary brachial plexus exploration and bilateral sural nerve grafting. *(Plast Reconstr Surg Glob Open 2017;6:e1540; doi: 10.1097/GOX.0000000000001540; Published online 25 October 2017.)*

INTRODUCTION

Primary brachial plexus exploration in infants with poor spontaneous motor recovery is practiced all over the world.[1–4] Intravenous access (IVA) in these infants have not been specifically investigated. Central lines are generally not used for IVA in these infants.[5] The use of the contralateral external jugular vein is an option. However, we find this option inconvenient because the line frequently gets blocked with turning of the neck to the contralateral side. Both lower limbs are prepared and draped for sural nerve graft harvesting and hence the feet are theoretically not available for IVA. The injured upper limb is also prepared and draped and is not available for IVA. This leaves the anesthetist with 1 upper limb for the application of the blood pressure cuff and the pulse oximetry as well as for IVA. In difficult IVA from this remaining upper limb, we have been using one of the feet for IVA. This will put the unsterile IVA site and tubing within the sterile field. Furthermore, manipulation of the lower limb during sural nerve harvesting may lead to dislodgement of intravenous cannula. The aim of this retrospective study was to investigate the infection rate and problems of intravenous infusions when the foot is used for IVA in these infants.

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Received for publication July 22, 2017; accepted August 29, 2017.

DOI: 10.1097/GOX.0000000000001540

PATIENTS AND METHODS

This study was approved by our local Research Committee. It is a retrospective study of 63 consecutive infants with obstetric paralysis undergoing primary brachial plexus reconstruction with bilateral sural nerve grafting, and in whom IVA was obtained from the foot. At our center, the infant is positioned supine during the entire surgical procedure (some centers[5] position the infants prone for endoscopic harvesting of sural nerve grafts). Preparation is done using povidone iodine. The ipsilateral neck and upper limbs are prepared and draped first. Next, preparation and draping of the lower limb without the IVA is done. Before preparation of the lower limb with IVA,

Disclosure: *Supported by the College of Medicine Research Center, Deanship of Scientific Research, King Saud University, Riyadh, Saudi Arabia. The Article Processing Charge was paid for by the authors.*

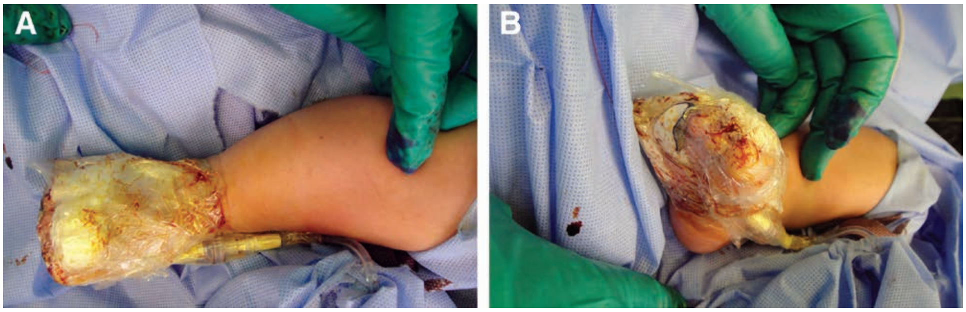

Fig. 1. The IVA site in the foot and tubing are within the sterile field. They have been painted with povidone iodine. Note that the Tegaderm securing the line is extending to the ankle dorsally (A). However, the heel and lateral malleolus are kept free ventrally (B).

Tegaderm (3M, St. Paul, MN) is applied on the foot including the distal part of the tubing of the intravenous line. Preparation of that limb will include the Tegaderm as well as the tubing of the intravenous line as shown in Figure 1. The Tegaderm is applied dorsally up to the ankle and ventrally up to the heel (Fig. 1).

All infants receive a single dose of prophylactic cephalosporin upon induction of anesthesia. After exploration of the brachial plexus at the neck, sural nerve grafts are harvested through a longitudinal leg incision extending from the lateral malleolus to the knee. We always harvest the nerve from the free lower limb (i.e., the limb without the IVA) first. Skin closure (with absorbable sutures) and wound dressing of the free lower limb are done before harvesting of the nerve from the contralateral lower limb (which is the limb with the IVA; Fig. 2). Topical povidone iodine is applied onto the skin wound edges before wound closure. The surgeon, the assistant, and the nurse then change their gloves and the instruments used for harvesting of the sural nerve graft are kept separate from the micro-instruments used in the neck. The lower limb with the IVA is then covered with a new drape, and surgery is completed at the neck by using fibrin glue for nerve graft coaptation. After completion of the procedure, the Tegaderm is partially released at the toes and the ankle may be further immobilized using a hard board (Fig. 3).

The charts of these infants were reviewed for wound infection and infections of the IVA site. Complications related to the intravenous infusion (such as cannula dislodgement, line blockage, and extravasation) were also documented.

RESULTS

The average age of these 63 consecutive infants was 4.1 months (range, 3–5 months). In all cases, the pediatric anesthetist failed to obtain IVA from the uninjured upper limb in the operating room. After obtaining the IVA from the foot, the anesthetist made sure that the intravenous fluid in the line was freely going and was not positional (i.e., it did not obstruct with ankle movements). Since inspection of the intravenous site (for extravasation) was difficult intraoperatively, we did not use pressure pumps for intravenous line infusion. This would make the identification of any extravasation or blockage easier.

The chart review did not show any case of leg or neck wound infection, or infections of the IVA site. No cannula dislodgement, line blockage, or extravasation occurred in any of the patients.

DISCUSSION

Serious complications in infants undergoing brachial plexus reconstruction include fluid over-load, phrenic nerve injury and accidental extubation.[5] Minor local wound complications have also been reported.[5] We are unaware of any study in the literature investigating the IVA and its related complications in these infants, and hence we are unable to compare our results with other studies.

The utilization of 1 foot for IVA puts the unsterile Tegaderm and intravenous tubing within the sterile field. Although the Tegaderm and the tubing are painted with iodine during the preparation of the limb, it is unknown if this will make them "sterile." We have taken this into consideration, and we have been maintaining certain precau-

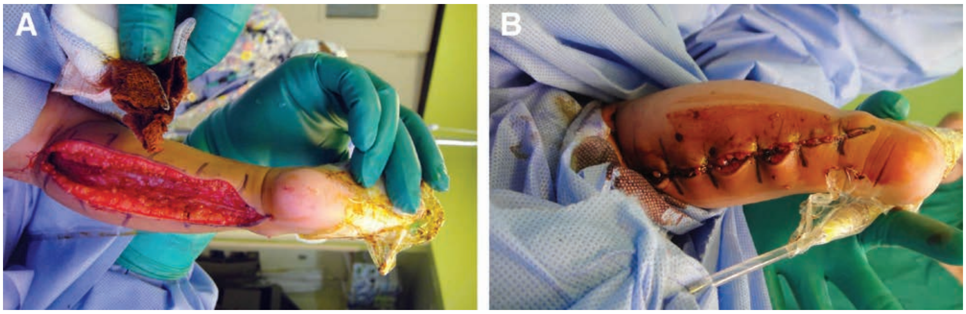

Fig. 2. Harvesting of the sural nerve graft (A) and wound closure (B) from the lower limb with the IVA.

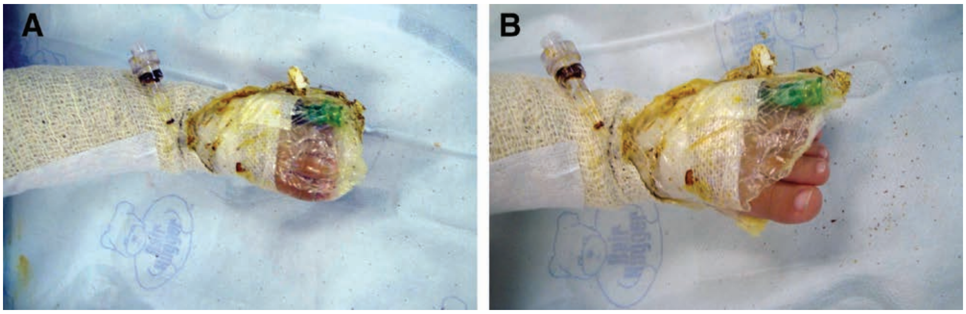

Fig. 3. A, Appearance of the foot after completion of the procedure and application of dressing. B, The Tegaderm is partially released at the toes and the foot will be further immobilized with a hard board before extubation.

tions. Harvesting of the sural nerve from the limb with the IVA is done after the initial neck exploration and nerve harvesting from the free lower limb. After nerve harvesting from the lower limb with IVA, the surgical and nursing teams change their gloves before going back to the neck. Finally, instruments used for harvesting of the sural nerve graft are kept on a separate table from other instruments; and that table is removed once the donor leg wound is closed. In our series, there have been no cases of leg or neck wound infections. Furthermore, there were no infections related to the IVA site. The utilization of the foot for IVA also puts the intravenous cannula at risk of dislodgement during limb manipulation for sural nerve graft harvesting. The surgeon and assistant were aware of this risk, and preventive methods were used such as wrapping of the foot with the adhesive Tegaderm and keeping the tubing loose at all times while lifting the leg up for nerve harvesting. In our series, we had no instances of cannula dislodgement, line blockage, or extravasation, indicating that our preventive methods were effective.

We have used regular drapes in the lower limb with the IVA. Long sheets of sterile Silastic drapes (as used for microscopes or endoscopic surgery) will do better than the regular drapes because they can provide greater length of exposed IV tubing so one can move the leg more freely. However, large Silastic drapes are more expensive.

Our study deals with the problem of IVA in the pediatric brachial plexus population. However, this is not unique to this group. Aesthetic surgeons can experience the same problem if for example they perform bilateral brachioplasty and bilateral leg surgery. Reconstructive surgeons can also experience the same issue in head and neck cancer surgery where a forearm flap may be raised from 1 forearm, the other is used for BP monitoring, and the legs are used for second flap harvesting.

In conclusion, the use of one of the feet for IVA within the sterile field is safe and acceptable in infants undergoing primary brachial plexus exploration and bilateral sural nerve grafting.

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