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TECHNICAL NOTE

Endoscopic robot-assisted C7 nerve root retrophalangeal transfer from the contralateral healthy side: A cadaver feasibility study

Transfert de la racine C7 controlatérale saine par voie rétropharyngienne endoscopique robot-assistée : étude de faisabilité sur cadavre

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KEYWORDS
C7 root;
Brachial plexus;
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Mini-invasive technique

Summary Controlateral C7 nerve root transfer in brachial plexus palsy requires a nerve graft and large incisions. This study investigated the feasibility of transferring the right C7 to the left C7 nerve root, without a graft, via a minimally invasive retropharyngeal approach. After installation of 6 trocars of 1 cm diameter in the supraclavicular space, a Da Vinci SI® robot was placed. After locating the right brachial plexus, the C7 root was sectioned flush with the clavicle, transferred behind the pharynx and sutured to the left C7 root severed at the foramen level. The duration of the procedure was 2 h 40 min. No technical difficulties were encountered. The hypothesis of this work was verified since it was possible to carry out a transfer of the right C7

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root on the left C7 root by direct retropharyngeal suture without graft and by a minimally invasive technique.

MOTS CLÉS
Racine C7 ;
Plexus brachial ;
Da Vinci ;
Robot ;
Technique mini-invasive

Résumé Le transfert de C7 controlatéral dans les paralysies du plexus brachial nécessite une greffe nerveuse et des grandes incisions. Ce travail étudiait la faisabilité du transfert de C7 droit sur C7 gauche, sans greffe par voie mini-invasive rétropharyngée. Après mise en place de 6 trocarts d'1 cm dans l'espace supraclaviculaire, un robot Da Vinci SI® a été installé. Après repérage du plexus brachial droit, la racine C7 a été sectionnée au ras de la clavicule, puis transférée derrière le pharynx pour la suturer à la racine C7 gauche sectionnée au ras du trou de conjugaison. La durée était de 2 h 40 min. Aucune difficulté technique n'a été rencontrée. L'hypothèse de ce travail était vérifiée puisqu'il était possible de réaliser un transfert de la racine C7 droite sur la racine C7 gauche par suture directe rétropharyngée sans greffe et par voie mini-invasive.

Introduction

Total transfer of the healthy contralateral C7 nerve root was proposed 25 years ago in the surgical treatment of total brachial plexus palsy, without an extraplexic donor nerve available [1]. A nerve graft was needed due to a gap between the two ends to be sutured. Several techniques have been described to reduce the problems of donor site morbidity and decrease the length of the graft or even eliminate its use [2]. All these techniques require large incisions to approach the nerve roots, harvest the graft and perform the sutures.

The original technique and its variants have two disadvantages: the need for a nerve graft with clinical results lower than a direct suture and the need for large incisions with sclerotic scars and aesthetic damage.

The hypothesis of this work was to verify on a fresh human cadaver the feasibility of transferring the right C7 root on the left C7 root without graft and by using a minimally invasive retropharyngeal approach.

Materials and methods

This study was carried out in an academic institution for surgical training. A fresh frozen human cadaver was thawed for the experimentation. The equipment consisted on: a Da Vinci SI® robot (Intuitive Surgical™, Sunnyvale, CA, USA), 2 Maryland® clamps (Intuitive Surgical™, Sunnyvale, CA, USA) and 1 Black Diamond® clamp (Intuitive Surgical™, Sunnyvale, CA, USA). Three surgeons worked on the study.

The surgical technique of transferring the right C7 root to the left C7 root involved 6 steps or phases. The first consisted on making 6 incisions of 1 cm each with respect to the right and left subclavicular regions of the cadaver, creating a working space joining the right and left supraclavicular regions by dissection using long scissors and finally inserting one trocar for each incision (Fig. 1). The second was to install the robot at the head of the subject (Fig. 2). The third step was to locate the roots C4 to C7 of the right brachial plexus,

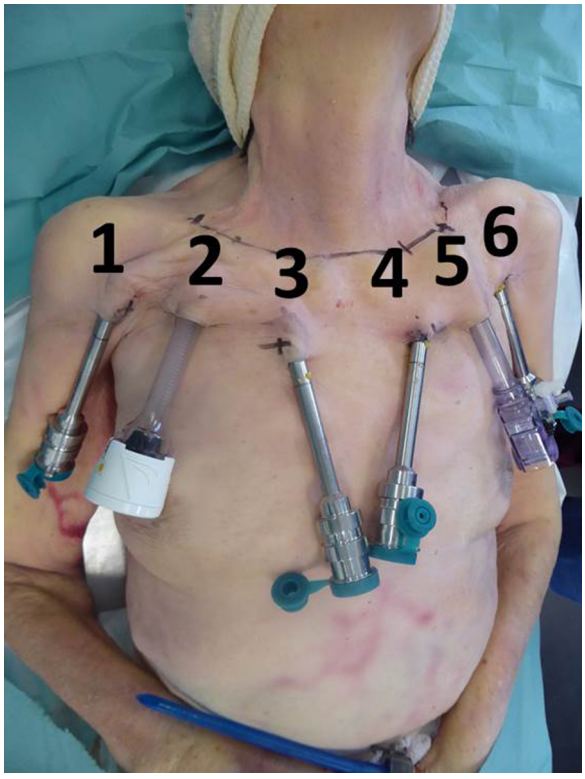

Figure 1 Thorax of a fresh cadaver. Three trocars were placed on the right (1, 2, 3) and on the left (4, 5, 6), including 1 central for the camera and 2 lateral for the instruments. The points of introduction of the trocars must be sufficiently far apart to avoid conflicts of instrumental arms of the robot. In practice, the insertion point of the camera trocar (2, 5) is situated opposite to the middle of the clavicle and the insertion points of the instrumental trocars a few centimeters from the ends of the clavicle (1, 3, 4, 6). The trocar insertion points must be sufficiently far from the work target to allow optimal triangulation of the camera arms and robot instruments. In practice, trocar insertion points are located a few centimeters below the clavicle.

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