Available online at
ScienceDirect
www.sciencedirect.com

Elsevier Masson France
EM|consulte
www.em-consulte.com

Hand Surgery and Rehabilitation 35 (2016) 81–84

Hand Surgery & Rehabilitation

Surgical technique

Video Animation

Robotically assisted harvest of the latissimus dorsi muscle: A cadaver feasibility study and clinical test case

Prélèvement robot-assisté du muscle latissimus dorsi : étude de faisabilité sur un cadavre et application sur un cas clinique

Satoshi Ichihara [a,b], Frédéric Bodin [c], John C. Pedersen [d], Paolo Porto de Melo [e], Jose Carlos Garcia Jr. [f], Sybille Facca [a], Philippe André Liverneaux [a,*]

[a] *Hand Surgery Department, University of Strasbourg, Strasbourg University Hospitals, FMTS, Icube CNRS 7357, 10, avenue Baumann, 67403 Illkirch, France*
[b] *Department of Orthopedic Surgery, Juntendo University, Tokyo, Japan*
[c] *Plastic Surgery Department, University of Strasbourg, Strasbourg University Hospitals, FMTS, Strasbourg, France*
[d] *Akron Plastic Surgeons, Akron, OH, USA*
[e] *Neurosurgery Department, São Paulo Military Área Hospital, Brazilian Army, São Paulo, Brazil*
[f] *Sports Medicine Division/Shoulder and Elbow Surgery Division, Pontifical Catholic University of Campinas, São Paulo, Brazil*

Received 17 June 2015; received in revised form 18 October 2015; accepted 20 January 2016
Available online 18 February 2016

Abstract

The applications of robotic surgery have quickly spread into a variety of surgical fields. Interest in robotic endoscopic surgery is high because of the small size of the incisions, cosmetic advantages, less invasive surgical techniques, decreased scar tissue, shorter duration of hospitalization and increased cost-effectiveness. We will describe an anatomical feasibility study and a clinical test case of robotically assisted pedicled transposition of the latissimus dorsi muscle.

Keywords: Robotic surgery; Endoscopic muscle harvest; Latissimus dorsi

Résumé

Les applications de la chirurgie robot-assistée se sont rapidement étendues dans de nombreuses disciplines chirurgicales. Les avantages de la chirurgie robot-assistée endoscopique avec de petites incisions sont l'intérêt esthétique, des techniques moins invasives, une diminution de la sclérose des parties molles, une hospitalisation de courte durée avec des coûts moins élevés. Nous présentons ici une étude de faisabilité anatomique et un cas clinique de prélèvement endoscopique du muscle latissimus dorsi.

Mots clés : Chirurgie robot-assistée ; Prélèvement musculaire endoscopique ; Latissimus dorsi

1. Introduction

The latissimus dorsi (LD) muscle is commonly used for various reconstructive surgeries [1]. Conventional open procedures for pedicled LD muscle harvest for breast reconstruction or LD tendon harvest for shoulder reconstruction [2] are the gold standard [3]. However, open procedures

* Corresponding author.
E-mail address: philippe.liverneaux@chru-strasbourg.fr (P.A. Liverneaux).

http://dx.doi.org/10.1016/j.hansur.2016.01.002
2468-1229/

have drawbacks associated with appearance, large amounts of scar tissue, donor-site morbidity, long hospitalization, seroma, and wound infection [4].

Endoscopically assisted muscle flap harvesting through small incisions aims to counter the disadvantages of conventional open procedures [5]. Many authors have worked to develop endoscopic procedures for pedicled LD muscle harvest for breast [6] or shoulder [7] reconstruction.

Endoscopic muscle harvest offers several potential advantages such as increased magnification, better wound healing, shorter hospitalization, and less postoperative pain at the donor site [1]. However, drawbacks of endoscopic muscle harvest include low-quality vision and more challenging instrument manipulation. Because endoscopy mainly uses saline and a two-dimensional (2D) camera, the view is inferior to gas insufflation [8]. In addition, endoscopy requires that the surgeon holds the camera and does not cancel physiological tremor; the quality of instrument manipulation needs to be improved [9].

The advantages of endoscopic robot-assisted muscle flap harvesting are enhanced precision, high resolution, three-dimensional (3D) view, gas insufflation instead of saline, hand-free camera manipulation, tremor filtration, and motion scaling [10,11]. These reasons drove Selber et al. to develop robotic procedures for pedicled LD muscle harvest for breast reconstruction [12,13].

The goal of our study was to extend the indications of the breast reconstruction procedure described by Selber et al. [12,13] to shoulder reconstruction. We performed a cadaver validation study, and then performed a clinical test case of robotically assisted surgery for pedicled LD muscle harvest for shoulder reconstruction.

2. Experimental study

The goal of this experimental study was to validate the procedure described by Selber et al. [12,13].

A fresh cadaver was placed in the left lateral position (Fig. 1a). A 4-cm axillary incision was made in front of the LD muscle pedicle along the axillary crease. From this incision, the thoracodorsal pedicle was identified and a vessel loop was placed around it for ease of visualization. After this identification, the entire LD muscle was carefully dissected free as far as possible to the iliac crest.

The 3D camera trocar portal was placed through a 1-cm incision, approximately 20 cm from the axillary fossa and at the anterior border of the LD muscle under direct vision through the axillary incision. Two instrument portals were placed symmetrically about 2 cm dorsal and 5$cm proximal and distal to the camera portal, respectively. The axillary incision was temporarily closed to maintain insufflation pressure and a working cavity. After portal placement, the robotic side cart was placed and the instrument arms were positioned approximately 60° to the plane of the floor under the survey of the 0° endoscopic camera (Fig. 1b). Then, the ports were docked and insufflation was applied.

Dissection was initiated along the undersurface of the muscle from the inferior angle of scapula to the inferior posterior border (Video 1). After the deep surface was dissected to the LD muscle edges, a grasper was used to retract the anterior edge of the muscle toward the chest wall; dissection proceeded over the superficial surface of the muscle.

Once both the deep and superficial surface dissection was completed, monopolar scissors were used to take the muscle off the inferior posterior border. Once the muscle had been released proximal to the inferior angle of scapula, the muscle was easily accessible through the axillary incision.

3. Clinical case

The clinical test case involved a 33-year-old woman who presented with postoperative shoulder fusion after repeated shoulder operations. She had atrophy of the shoulder girdle muscles due to iatrogenic axillary nerve palsy (Fig. 2a). From a

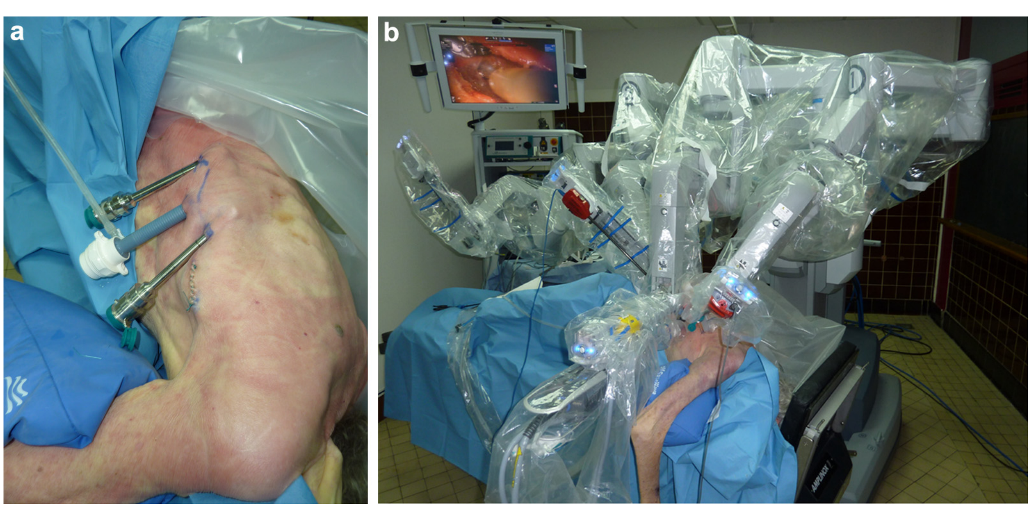

Fig. 1. Cadaver experiment for robot-assisted latissimus dorsi harvesting. Fresh cadaver installed in left decubitus. One 3D camera portal and two instrument portals were placed in the left chest wall (a). The 3D robotic camera and robotic instruments are introduced from outside of the thoracic cavity. On the screen, a Cadiere robotic forceps is grasping the latissimus dorsi (b).