49. Chang DW. Lymphaticovenular bypass surgery for lymphedema management in breast cancer patients. Handchir Mikrochir Plast Chir 2012;44:343–7.
50. Chang DW, Suami H, Skoracki R. A prospective analysis of 100 consecutive lymphovenous bypass cases for treatment of extremity lymphedema. Plast Reconstr Surg 2013;132:1305–14.
51. Torrisi JS, Joseph WJ, Ghanta S, et al. Lymphaticovenous bypass decreases pathologic skin changes in upper extremity breast cancer-related lymphedema. Lymphat Res Biol 2015;13(1):46–53.
52. Boccardo F, De Cian F, Campisi CC, et al. Surgical prevention and treatment of lymphedema after lymph node dissection in patients with cutaneous melanoma. Lymphology 2013;46:20–6.
53. Boccardo FM, Casabona F, Friedman D, et al. Surgical prevention of arm lymphedema after breast cancer treatment. Ann Surg Oncol 2011;18:2500–5.
54. Campisi C, Bellini C, Campisi C, et al. Microsurgery for lymphedema: clinical research and long-term results. Microsurgery 2010;30:256–60.
55. Gilbert A, O'Brien BM, Vorrath JW, et al. Lymphaticovenous anastomosis by microvascular technique. Br J Plast Surg 1976;29:355–60.
56. O'Brien BM, Chait LA, Hurwitz PJ. Microlymphatic surgery. Orthop Clin North Am 1977;8:405–24.
57. Yamamoto T, Chen WF, Yamamoto N, et al. Technical simplification of the supermicrosurgical side-to-end lymphaticovenular anastomosis using the parachute technique. Microsurgery 2014.
58. Mihara M, Hara H, Hayashi Y, et al. Upper-limb lymphedema treated aesthetically with lymphaticovenous anastomosis using indocyanine green lymphography and noncontact vein visualization. J Reconstr Microsurg 2012;28:327–32.
59. Narushima M, Mihara M, Yamamoto Y, et al. The intravascular stenting method for treatment of extremity lymphedema with multiconfiguration lymphaticovenous anastomoses. Plast Reconstr Surg 2010;125:935–43.
60. Yamamoto T, Yoshimatsu H, Narushima M, et al. A modified side-to-end lymphaticovenular anastomosis. Microsurgery 2013;33:130–3.
61. Yamamoto T, Yoshimatsu H, Narushima M, et al. Split intravascular stents for side-to-end lymphaticovenular anastomosis. Ann Plast Surg 2013;71:538–40.
62. Yamamoto T, Yoshimatsu H, Narushima M, et al. Sequential anastomosis for lymphatic supermicrosurgery: multiple lymphaticovenular anastomoses on 1 venule. Ann Plast Surg 2014;73:46–9.
63. Yamamoto T, Yoshimatsu H, Yamamoto N, et al. Side-to-end lymphaticovenular anastomosis through temporary lymphatic expansion. PLoS ONE 2013;8:e59523.
64. Althubaiti GA, Crosby MA, Chang DW. Vascularized supraclavicular lymph node transfer for lower extremity lymphedema treatment. Plast Reconstr Surg 2013;131:133e–135e.
65. Becker C, Assouad J, Riquet M, et al. Postmastectomy lymphedema: long-term results following microsurgical lymph node transplantation. Ann Surg 2006;243:313–15.
66. Chen R, Mu L, Zhang H, et al. Simultaneous breast reconstruction and treatment of breast cancer-related upper arm lymphedema with lymphatic lower abdominal flap. Ann Plast Surg 2014;73(Suppl. 1):S12–17.
67. Cheng MH, Lin CY, Patel K. A prospective assessment of anatomic variability of the submental vascularized lymph node flap. Plast Reconstr Surg 2014;134:33.
68. Nguyen AT, Chang EI, Suami H, et al. Algorithmic approach to simultaneous vascularized lymph node transfer with microvascular breast reconstruction. Ann Surg Oncol 2015.
69. Poon Y, Wei CY. Vascularized groin lymph node flap transfer for postmastectomy upper limb lymphedema: flap anatomy, recipient sites, and outcomes. Plast Reconstr Surg 2014;133:428e.
70. Sapountzis S, Ciudad P, Lim SY, et al. Modified Charles procedure and lymph node flap transfer for advanced lower extremity lymphedema. Microsurgery 2014;34:439–47.
71. Sapountzis S, Singhal D, Rashid A, et al. Lymph node flap based on the right transverse cervical artery as a donor site for lymph node transfer. Ann Plast Surg 2014;73:398–401.
72. Lin CH, Ali R, Chen SC, et al. Vascularized groin lymph node transfer using the wrist as a recipient site for management of postmastectomy upper extremity lymphedema. Plast Reconstr Surg 2009;123:1265–75.
73. Patel KM, Lin CY, Cheng MH. A prospective evaluation of lymphedema-specific quality-of-life outcomes following vascularized lymph node transfer. Ann Surg Oncol 2015;22:2424–30.
74. Patel KM, Chu SY, Huang JJ, et al. Preplanning vascularized lymph node transfer with duplex ultrasonography: an evaluation of 3 donor sites. Plast Reconstr Surg Glob Open 2014;2:e193.
75. Qiu SS, Chen HY, Cheng MH. Vascularized lymph node flap transfer and lymphovenous anastomosis for Klippel-Trenaunay syndrome with congenital lymphedema. Plast Reconstr Surg Glob Open 2014;2:e167.
76. Patel KM, Chu SY, Huang JJ, et al. Pre-planning vascularized lymph node transfer with duplex ultrasonography: a prospective evaluation of three common donor sites. Plast Reconstr Surg 2014;134:32.
77. Cheng MH, Huang JJ, Wu CW, et al. The mechanism of vascularized lymph node transfer for lymphedema: natural lymphaticovenous drainage. Plast Reconstr Surg 2014;133:192e–198e.
78. Launois R, Mègnigbêto AC, Pocquet K, et al. A specific quality of life scale in upper limb lymphoedema: the ULL-27 questionnaire. Lymphology 2002;35:181–7.
79. Pusic AL, Cemal Y, Albornoz C, et al. Quality of life among breast cancer patients with lymphedema: a systematic review of patient-reported outcome instruments and outcomes. J Cancer Surviv 2013;7:83–92.

9

Robotic Applications in Plastic and Reconstructive Surgery

Jesse Selber

INTRODUCTION

In recent years, robotic surgery has grown to dominate minimally invasive applications in the various surgical subspecialties. The currently available robotic surgical platform (da Vinci, Intuitive Surgical, Sunnyvale, CA) consists of two integrated subsystems: a surgeon console and a patient side cart (Fig. 9.1). While seated at the console, the surgeon controls the instruments and endoscope using two small hand-operated mechanisms residing within the console (Fig. 9.2). The instruments themselves are capable of supination, pronation, flexion and extension, and grasping, much like the human hand, making them considerably more agile than standard endoscopic instrumentation (Fig. 9.3). The endoscope (Fig. 9.4) provides two independent images that are fused to form a 3-dimensional (3-D) view at the console.

OPERATING INTERFACE

The basic surgical robotic interface is what is referred to in engineering as a "master-slave" model. The surgeon sits at a console and controls the movements of the arms and instruments remotely, but in real-time. The movements performed by the surgeon are mimicked precisely by the movements of the robotic arms and wrists. The hand controls are designed in such a way that gross movements of the surgeon's arms in space translate into movements of the large robotic arms, and finer movements of the surgeon's wrist and fingertips are translated into fine motion at the tips of the instruments, which are controlled by a pulley system.

Instrument motion is very smooth and precise. Tremor is eliminated completely and motion paths of the robotic instruments are smaller and smoother than the surgeon's own motion. There is no haptic, or sensory, feedback delivered by the robotic interface, so there is no force feedback to aid the surgeon in understanding tissue reaction. This is cited as the principal disadvantage of the robotic surgical interface. All data about tissue reaction must be extracted

Figure 9.1 The da Vinci system is composed of integrated subsystems. A surgeon console where the surgeon sits, a patient side cart, which interacts directly with the patient, and a vision tower, which houses the central processing unit, camera, light source, and monitor. (©2016 Intuitive Surgical, Inc. Used with permission.)

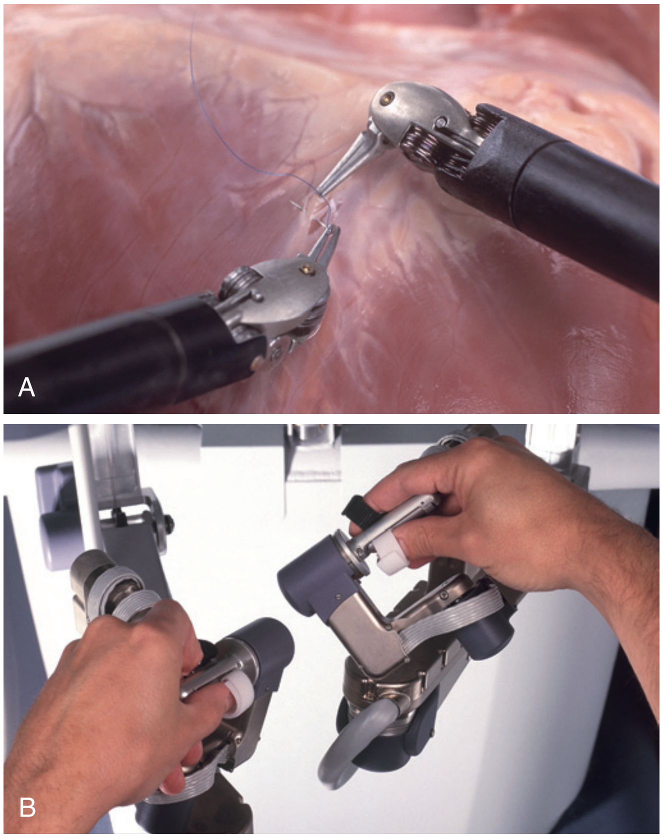

Figure 9.2 The surgeon controls the robotic arm (A) using two hand-operated mechanisms that reside within the surgeon console (B). (©2016 Intuitive Surgical, Inc. Used with permission.)