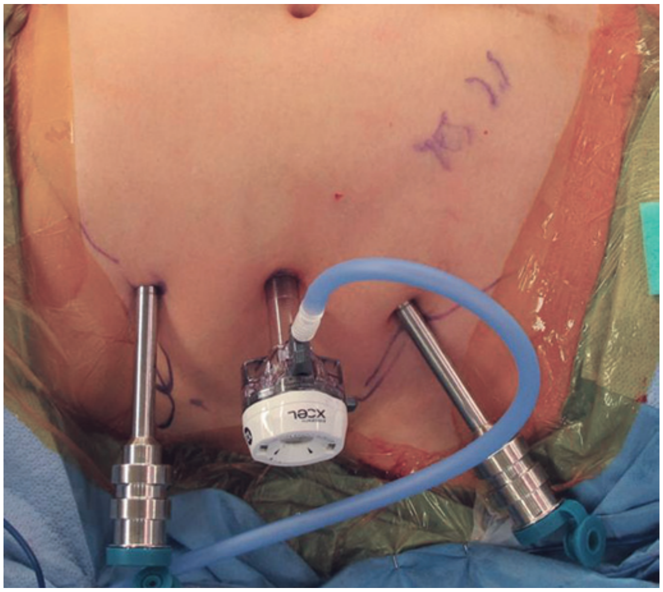

Figure 9.7 For the robotic rectus harvest, the contralateral costal margin and iliac crest are marked along a line connecting the anterior axillary line and the anterior superior iliac spine. The mid-point between these two landmarks and 2 cm lateral to it is the desired location of the 12 mm camera port. On either side of the camera port, about three finger breadths away, is the planned location of the two 8 mm instrument ports. Once port location is determined, a 15 blade is used to cut the skin. A 12 mm port is placed using the corresponding trochar. The robotic endoscope can then be inserted and held by hand to visualize placement of the remaining two 8 mm ports. Here, all three ports are in place and the robot is ready to be docked.

2. Harvest of the rectus abdominis muscle when a skin island is not necessary or desirable:
   a. Free flap for extremity or scalp coverage
   b. Pedicled flap for pelvic reconstruction when:
      i. Ablative surgery is performed without a laparotomy
      ii. Perineal skin or vaginal mucosa does not need to be replaced
      iii. Pelvic dead space volume is low to moderate
      iv. Abdominal adiposity would create an oversupply of tissue.

ROBOTIC MICROVASCULAR ANASTOMOSIS

The superior precision, motion scaling, tremor elimination and high magnification, 3-dimensional, HD image all make the robotic platform well-suited to performing microvascular anastomosis.[20] Where access to recipient vessels is difficult (some head and neck cases, hepatic artery reconstruction, intra-abdominal or intracerebral bypass) or vessels are sufficiently small caliber that hand-sewing becomes difficult (LV bypass, supermicrosurgery), the robot can help augment or overcome the limits of human technical ability (Video 9.3).[21,22]

In many cases, the microluminal surgery is in the open field and access is straightforward. Even in these cases, the surgical robot has distinct advantages over conventional microsurgery with respect to precision. The patient side cart is not much bigger than a microscope, so the robot can be viewed as replacement technology for the microscope that simply allows much more precise operating movements by the surgeon.

INDICATIONS

1. Any microvascular anastomosis that is technically limited by physical access (hepatic artery bypass, intracerebral bypass, ensconced recipient vessel anatomy)
2. Any vessel caliber that is at or beyond the comfortable limits of the operator's technical ability (lymphovenous bypass, perforator to perforator anastomosis, digital replantation).

FUTURE DIRECTIONS

Surgical robotics has made massive strides over the last 10 years, and plastic surgeons are just beginning to uncover the potential for our specialty and our patients. It is important for us to recognize how early in development this technology is: the da Vinci is the first generation of robots created by a single vendor. This is analogous to the first computers, which were the size of a room and could barely add a column of numbers. Now there are handheld phones with 1 million times that computing speed. A similar cost and technology curve can be expected for robotics in general and surgical robotics in particular. In the near future we can expect smaller, more task-oriented machines, decision-making algorithms, augmented reality vision systems, better optics, and sensory feedback. These are not a matter of *if*, but *when*. Much more surgery will be performed robotically, as this has been the trend for most highly technical human tasks. As plastic surgeons we will accrue the benefits of a technology boom in this area, but we will need to incorporate robotics into our training, so we can take advantage of this incredible future opportunity.

SUMMARY

Robotic surgery is a relatively new technology that continues to improve and evolve. Applications in plastic surgery have recently emerged, including transoral reconstruction of the oropharynx, robotic muscle harvest for free and pedicled flaps, and robotic microsurgical anastomoses. These techniques offer a variety of significant advantages over their conventional counterparts, and promise to expand the reconstructive palette for plastic surgeons.

CASE 9.1 Transoral Robotic Reconstruction of Oropharyngeal Defect

RH is a 62-year-old man with a history of recurrent T3N1M0 squamous cell carcinoma of the left posterolateral pharynx following failed radiation treatment. He underwent a combination transoral robotic resection with the addition of a lateral pharyngotomy, and a left neck dissection. Although the pharyngotomy was small (~15 cm^2), a large portion of the pharynx (~50 cm^2) was resected from the epiglottis to the soft palate. A 6×9 cm radial forearm flap was harvested. The upper pharyngeal component was inset robotically. The remainder of the inset was completed through the neck. The patient side cart, which was already in position from the robotic resection and inset, was used to perform the arterial anastomosis. The venous anastomosis was then coupled under loupe magnification. The patient was decannulated and discharged within a week, and passed a modified barium swallow study 3 weeks postoperatively. His speech is intelligible and he is tolerating a regular diet, independent of tube feeds (Video 9.4).

CASE 9.2 Robotic Harvest of Latissimus Dorsi for Breast Reconstruction

KM is a 48-year-old woman with a history of T1N0M0 invasive ductal carcinoma of the right breast with 34B breasts, grade I ptosis, and a BMI of 22. She was scheduled to undergo NAC sparing mastectomy, sentinel lymph node biopsy, and immediate implant-based reconstruction. At the time of mastectomy, she underwent robotic harvest of the latissimus dorsi muscle for lower pole coverage. A lateral mastectomy incision and the sentinel lymph node incision were used in combination with two ports, which were used as drain sites. No additional incisions that would not have otherwise been present were required to harvest the muscle. After a good expansion phase, she underwent exchange for a 500 cc implant and a simultaneous contralateral augmentation with a 300 cc implant (Fig. 9.8, Video 9.5).

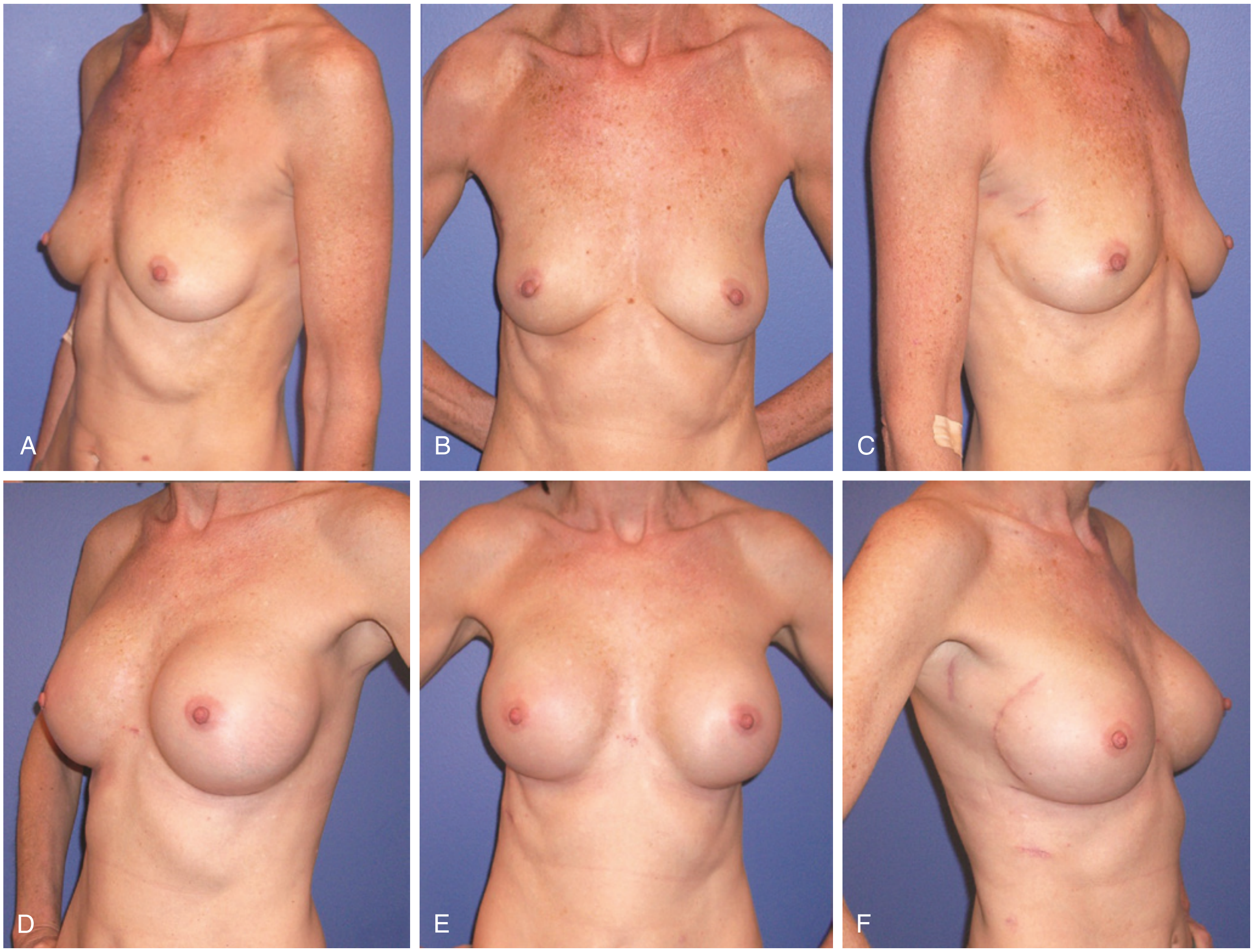

Figure 9.8 This patient underwent right nipple-areolar sparing mastectomy, with robotically harvested latissimus flap at stage I. The muscle was used along the inferior pole in much the same manner as ADM is used. At stage II, the expander was replaced with a permanent implant, and a contralateral augmentation mammoplasty was performed (A–C, top) preoperative views. (D–F, bottom) 6-month follow-up. The incisions visible on the reconstructed breast in image F include the mastectomy incision, the sentinel lymph node incision, and the camera port incision.