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Kent Goodman, Mary Kathryn Abel, Courtney Lawhn-Heath, Julissa Molina-Vega, Ella F. Jones, and Rita A. Mukhtar

Video content accompanies this article at http://www.surgonc.theclinics.com.

18F-fluoroestradiol (18F-FES) is a Food and Drug Administration-approved radiopharmaceutical used for molecular imaging of the estrogen receptor (ER). When combined with PET, 18F-FES may improve the diagnosis of ER-positive breast cancer in the metastatic setting and provide insights into tumor heterogeneity. In this article, we review data on the use of 18F-FES imaging for treatment selection, staging, imaging lobular breast cancer, and the novel breast specific imaging tool, dedicated breast PET.

5-Aminolevulinic Acid Imaging of Malignant Glioma 581
Guan Li, Adrian Rodrigues, Lily Kim, Cesar Garcia, Shruti Jain, Michael Zhang, and Melanie Hayden-Gephart

Video content accompanies this article at http://www.surgonc.theclinics.com.

High-grade glioma is the most common malignant primary brain tumor in adults. Glioma infiltration renders it difficult to treat and likely to recur. Increasing the extent of resection has been associated with improving progression-free survival and overall survival by several months. The introduction of 5-aminolevulinic acid (5-ALA) fluorescence-guided surgery has allowed surgeons to better differentiate between neoplastic tissue and normal tissue, thus achieving greater extent of resection. The development of new intraoperative imaging modalities in combination with 5-ALA may provide additional benefits for glioma patients.

Advances in Imaging to Aid Segmentectomy for Lung Cancer 595
Kate Krause, Lana Y. Schumacher, and Uma M. Sachdeva

Pulmonary segmentectomy has become a widely accepted technique for resection of early-stage lung cancers. Intraoperative identification of small nodules within the lung parenchyma and definition of segmental anatomy are essential for oncologic segmental resection and significantly enhanced by recent advances in imaging techniques. Advances in imaging for nodule
localization, using preoperative markers and three-dimensional computed tomography, delineation of segmental anatomy, and sentinel lymph node mapping have become important components of planning and performing minimally invasive anatomic segmentectomies and are particularly well suited for the evolving robotic-assisted platform.

**Indocyanine Green Use During Esophagectomy**

Michael H. Gerber and Stephanie G. Worrell

During an esophagectomy, many factors influence the anastomosis. Surgical factors include anastomotic tension, location of the anastomosis, surgical technique, and perfusion of the conduit. The use of fluorescent angiography is a possible avenue for more objective evaluation of the gastric conduit. There is a lot of variability in the way this tool has been used and what the results indicate. This article will discuss the various methods of fluorescent angiography to determine intestinal perfusion using indocyanine green and fluorescent imaging and the data on the association with clinical outcomes.

**Innovations in Parathyroid Localization Imaging**

Claire E. Graves, Quan-Yang Duh, and Insoo Suh

During cervical surgery, localization and identification of parathyroid glands is key to both the removal of abnormal hyperfunctioning glands and the preservation of normal glands. The challenging nature of parathyroid localization has fostered innovation in imaging techniques to localize glands both before and during cervical operations. Advances in preoperative imaging include PET-based imaging modalities paired with computed tomography or MRI for anatomic correlation. During surgery, both parathyroid autofluorescence and contrast-enhanced fluorescence techniques are useful adjuncts for intraoperative identification.

**Molecular and Anatomic Imaging of Neuroendocrine Tumors**

Laszlo Szidonya, Eunkyung Angela Park, Jennifer J. Kwak, and Nadine Mallak

Positron emission tomography (PET) with somatostatin receptor (SSTR) ligands has taken the lead in the imaging of neuroendocrine tumors (NETs). In this article, we review the role of SSTR PET scan in the management of NETs, including the indications for the scan, pitfalls in interpretation, and imaging selection criteria for peptide receptor radionuclide therapy. We also discuss the complementary role of fluorodeoxyglucose PET particularly for patients with high-grade disease.

**Applications of Three-Dimensional Printing in Surgical Oncology**

Catherine T. Byrd, Natalie S. Lui, and H. Henry Guo

A variety of three-dimensional (3D) printing techniques and materials facilitate the creation of customized models that promise to improve surgical procedures and patient outcomes. Three-dimensional-printed models allow patients, trainees, and experienced surgeons to explore anatomy through direct visualization and tactile feedback. Although 3D-printed models serve a range of purposes including preoperative planning,
education, skills refinement, patient-specific intraprocedural guides, and implants, much work remains to decrease the turnaround time and cost of printing models, collect long-term effectiveness data, and refine regulatory oversight of 3D printing in medicine.

**Intraoperative Molecular Imaging of Lung Cancer: A Review**
Natalie S. Lui and Sunil Singhal

Intraoperative molecular imaging shows great promise in the surgical treatment of lung cancer, in particular tumor localization, margin assessment, identification of additional nodules, and even potentially lymph node assessment. Advances in imaging agents and fluorescence surgical cameras will be the key. Although no imaging agent is currently Food and Drug Administration approved, targeted, near-infrared agents such as OTL38 are in phase III trials.

**Current and Future Applications of Fluorescence-Guided Surgery in Head and Neck Cancer**
Estelle Martin, Marisa Hom, Lucas Mani, and Eben L. Rosenthal

Despite improvements in medical management of head and neck cancers, positive surgical margin rates have remained relatively unchanged in the past 30 years, emphasizing a need for improved intraoperative imaging and tumor visualization. This review provides a detailed summary on preoperative anatomic imaging techniques, nonspecific fluorescence imaging modalities, the recent emergence of tumor-targeting fluorophores for intraoperative imaging, and the future of fluorescence-guided surgery in head and neck cancer.

**Contrast-Enhanced Intraoperative Ultrasound of the Liver**
Gloria Y. Chang, David T. Fetzer, and Matthew R. Porembka

Contrast-enhanced intraoperative ultrasound (CE-IOUS) is a relatively new but valuable tool that is increasingly used as an adjunct to computed tomography, MRI, and IOUS for patients undergoing liver surgery. CE-IOUS has an important role in 2 main settings: the discrimination of indeterminate lesions detected in cirrhotic livers by conventional IOUS and in the detection of colorectal liver metastasis that may be overlooked by other imaging modalities. The intraoperative nature of the imaging and interpretation allows for CE-IOUS to directly affect surgical decision-making that may importantly affect patient outcomes.