

ABDOMINAL IMAGING AND INTERVENTION

*Stuart G. Silverman, M.D.
Medical Director
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Note. The following was excerpted from what was submitted to the Department as part of the HMS Review.

Staff

Stuart G. Silverman, MD – Medical Director, Abdominal Imaging and Intervention; Professor of Radiology, HMS

Raquel O. Alencar, MD – Instructor in Radiology, HMS

John M. Braver, MD – Assistant Professor of Radiology, HMS

Ruth M. Dunne, MD – Instructor in Radiology, HMS (commencing half time in All, 7-14)

Ramin Khorasani, MD – Department Vice Chair, Quality and Safety; Director, Medical Imaging Information Technology (MIIT); Director, Center of Evidence-Based Imaging (CEBI); Associate Professor of Radiology, HMS

William W. Mayo-Smith, MD – Department Vice Chair, Education (commencing Sept 2014); Associate Professor of Radiology, HMS

Cheryl A. Sadow, MD – Assistant Professor of Radiology, HMS

V. Anik Sahni, MD – Instructor in Radiology, HMS

Nisha Sainani, MD – Instructor in Radiology, HMS

Steven E. Seltzer, MD – Department Chair, Professor of Radiology, HMS

Atul Shinagare, MD – Instructor in Radiology, HMS (switching to DFCI full time 7-14)

Paul B. Shyn, MD – Medical Director, Cross-Sectional Interventional Radiology; Assistant Professor of Radiology, HMS

Servet Tatli, MD – Medical Director, Abdominal Imaging and Intervention Fellowship, Assistant Professor, of Radiology HMS

Clare M. Tempany, MD – Department Vice Chair, Radiology Research; Professor of Radiology, HMS

Kemal Tuncali, MD – Instructor in Radiology, HMS

Clinical Services

The Abdominal Imaging and Intervention Section is comprised of an organ-system-based, disease-focused section. The Section consists of academic radiologists sub-specializing in imaging and intervention of gastrointestinal and genitourinary disorders. As stated in the Section's Policy Manual, the Section's mission is to provide the highest possible quality of care of patients, pursue on-going and new areas of research, and develop

and participate in education and training programs at all levels of medical education. The Section aims to allow all staff members to maximize their productivity and develop expertise within abdominal imaging and intervention.

Specific Section goals include: 1. To be the best all-around abdominal radiology section in the country, 2. To provide the best possible quality of patient care including subspecialty expertise in each of the major organ systems, and in each of the major imaging and interventional technologies employed in the abdomen. 3. To become academic leaders in abdominal imaging and intervention with national, if not world-recognition in several areas. 4. To participate in education and training programs at all levels of medical education, and 5. To provide the best quality of work life for academic physicians in an environment that both fosters the pursuit of academic career goals, and maintains a healthy and enjoyable lifestyle.

CT: The Abdominal Imaging and Intervention section performs and interprets approximately 40-50 CT scans per day derived from 30 indication-specific protocols. In addition to general evaluations, surveys, and staging examinations of cancerous and noncancerous conditions, specific examinations include special techniques such as CT urography, CT enterography, and CT colonography. State-of-the-art multichannel scanners are used.

MRI: The Abdominal Imaging and Intervention section performs and interprets approximately 20-30 MRI exams per day derived from 29 indication-specific protocols. In addition to general evaluations, surveys and staging examinations of cancerous and noncancerous conditions, specific examinations include special techniques such as, MR cholangiopancreatography, MR enterography, MR defecography, anorectal MRI, obstetrical MRI, and multiparametric MRI of the prostate gland.

Fluoroscopy: The Abdominal Imaging and Intervention section performs 20-25 Fluoroscopy examinations per day derived from 20 protocols. Radiography and fluoroscopy of the gastrointestinal and genitourinary tracts are conducted; specific examinations include esophagography, upper GI series, barium enema, sinography, abscessography, cystography, voiding cystourethrography, urethrography, and hysterosalpingography.

Cross-Sectional Interventional Radiology (CSIR): As part of the Department's CSIR service, the Abdominal Imaging and Intervention Section performs 15-20 interventional radiology procedures per day including all abdominal biopsies, and all fluid collection and abscess catheter drainages throughout the body, including the chest and musculoskeletal system. US, CT, and in selected cases, MRI and PET/CT are used to guide IR procedures. Care is provided 24/7 with emergency procedures performed frequently on weekend days and on occasion at night.

Tumor Ablations: The Abdominal Imaging and Intervention section performs 4-6 ablations per week (over 1375 since the Program started) throughout the body including the abdomen, the chest and musculoskeletal system. US, CT, MRI, and PET/CT, housed in an NIH-funded advanced multimodality image guided operating and interventional suite (AMIGO) are used to guide ablations using a variety of ablative agents including RF ablation, cryoablation, microwave ablation, and ethanol. A full –service approach is taken in which patients are seen in an ablation clinic and admitted to abdominal imaging and intervention staff. The Section serves as the principal 'translational arm' for thermal ablation research conducted in the Image-Guided Therapy Program (See Research Section of the Departmental Review). In 2013, Abdominal Imaging and Intervention staff performed more interventional PET/CT and Interventional MRI procedures in AMIGO than any other Department in the institution.

Tumor Metric Service: Abdominal Imaging and Intervention section staff developed and direct the Department's 'Tumor Metric Service', a program that offers radiological services to clinical trials both inside and outside Partners HealthCare. There are currently 31 active trials being serviced by the Section.

Relationships to Other Departments

The Abdominal Imaging and Intervention Section works closely with several divisions in other departments including Gastroenterology, Urology, General Surgery, as well as several oncology groups at the Dana Farber Cancer Institute (DFCI) including the GI, GU, sarcoma, and breast programs. The Section plays a leading role on the Executive Committee of the Joint Center for Cancer Precision Medicine that includes DFCI, BWH, and Children's Hospital and involves surgery, pathology in addition to radiology.

Abdominal Imaging and Intervention faculty are involved with several interdisciplinary research projects, and attend regularly scheduled case review conferences and work rounds. These include pancreaticobiliary conference, uroradiology conference, general surgery rounds, liver tumor board, and inflammatory bowel disease conference.

Research Activities

Programmatically, the Abdominal Imaging and Intervention Section has ongoing research projects focused on GI and GU diseases and oncology, and other projects centered around abdominal imaging and interventional radiology techniques. Current GI-disease-focused research include projects in pancreatitis, pancreatic cancer, and inflammatory bowel disease. GU-disease-focused research projects include renal mass evaluation and management, and prostate cancer evaluation and management. CT-technique-focused research projects include CT urography, and dual energy. MR-technique-focused research projects include diffusion-weighted imaging. IR-focused research include projects in tumor ablations, biopsy, and abscess drainage. Oncology research also includes an active Research Biopsy Program in which over biopsies are conducted as part of over 150 clinical trials based at DFCI.

Abdominal Imaging and Intervention Section faculty have authored numerous grants (See Research Section of Departmental Review). In addition, the Abdominal Imaging and Intervention Section publishes approximately 40-50 publications each year; these include original works, review articles, book chapters, and books. As of the end of June, 2014, 48 manuscripts were either published or 'in-press' for 2014. This brings the past seven-year publication total to 392. (2007:43, 2008:43, 2009:46, 2010:39, 2011:57; 2012:61, 2013:55; 2014:48. The list of Section publications can be found at the end of this Section's report, arranged by year and alphabetized by author. The yearly report of the Section's publications can be found also on the Section's website:

<https://www.brighamandwomens.org/radiology/abdominal-imaging/about-us>

Clinical practice changes as a result of Abdominal Imaging and Intervention research

The following represents a list of the most substantial contributions in research, i.e., those that are 'firsts', have led to transformative clinical practice change on a national level, and/or represent areas of investigation in which BWH abdominal radiologists are national leaders.

- 1) One of the first abdominal radiology sections to introduce currently employed techniques for CT urography – a technique that virtually eliminated the use of IV urography in adults and radically changed the approach to patients with hematuria and other disorders of the urinary tract. Subsequent research demonstrated its value in clinical practice and led to 15 original publications, several reviews, and a textbook. Notable papers since

the last Review – McTavish et al Radiology; Silverman et al, Radiology 2006; Silverman et al Radiology 2009 (highlighted on the Journal issue's cover shown here); Shinagare et al, Am J Medicine 2014.



- 2) One of the leading abdominal radiology sections in guiding the appropriate evaluation of incidental renal masses. Notable papers since the last Review - Jinazaki et al, 2004; Silverman et al, RadioGraphics 2007, Silverman et al, Radiology 2008; Berland et al, JACR 2010; O'Connor et al, Radiology 2013; Jinzaki et al Abdominal Imaging 2014; Maeharea et al, AJR (in press).
- 3) The leading abdominal radiology section on the use of percutaneous biopsy to diagnose and guide the management of renal masses. Research and publications defined the role and the value of biopsy in preventing unnecessary nephrectomies for benign renal masses. Prior to our works, biopsy was rarely used in clinical practice; now it is fully embraced by urologists and used for almost all small solid renal masses and several other specific clinical indications. Notable papers since the last Review – Rybicki et al, AJR 2003; Tuncali et al, AJR 2004; Silverman et al, Radiology 2006.
- 4) A leading institution in the design and development of MRI-guided high intensity focused ultrasound. Although largely still in the pre-clinical evaluation stage, this technique promises to offer minimally invasive treatment options for a variety of indications including uterine leiomyomas and painful bone metastases. Notable papers since the last Review – Fennessy et al, Radiology 2007; Stewart et al, Obstet Gynecol 2007; Lenard et al, Radiology 2008; Tempany et al, JMRI 2008; Kelloff et al AJR 2009; Taran et al Obstet Gynecol 2009; Fennessy et al, Radiology 2011; Fennessy et al, JACR 2011.
- 5) A leading institution of the use of multiparametric MRI to diagnose and stage prostate cancer and guide management using both imaging and percutaneous biopsy. Coupled with other institutions, novel MRI-guided biopsy techniques have been developed and have contributed to the clinical paradigm shift of obtaining pre-biopsy MRI, and guiding biopsy with MRI alone or with US in which MR images are fused.. Notable papers since the last Review – Zhang et al, Urology 2007; Weinreb et al, Radiology 2009; Federov et al, JMRI 2012; Hegde et al, MRI 2013.
- 6) As one of the most active Sections in the country in percutaneous tumor ablation, BWH abdominal faculty have successfully translated the advances in interventional MRI (developed mostly in the laboratory in the '80s and technical instrumentation of the '90s) to a thriving clinical service that has led to 160 research publications in tumor ablation (See Research section in Departmental review). Notable papers since the last Review – Shankar et al AJR 2004; Hui et al JVIR 2008; Shyn et al Clin Rad (in press); Dunne et al Eur J Rad (in press),

- 7) Developed simulation, planning and advanced targeting and 3D assessment methods for tumor ablation. Notable papers since the last Review – Silverman et al, AJR 2004; Das et al, Radiology 2006; Bricault et al, Radiology 2006; Elhawary et al Academic Rad 2010; Liu et al, IEEE 2012; Moradi et al, IEEE 2012; Shyn et al, Eur Rad 2012; Tatli et al, JMRI 2013; Shyn et al, AJR (in press).
- 8) One of the first Sections in the country to report initial experience with PET/CT-guided intervention including ablation. Notable papers since the last Review – Tatli et al, Radiology 2010 (highlighted on the Journal issue's cover shown here); Tatli et al, JVIR 2011; Shyn et al, JVIR 2011; Shyn et al Clin Rad (in press)



- 9) One of the first Sections to utilize PET/CT in patients with inflammatory bowel disease. Notable papers since the last review – Shyn et al 2010; Shyn et al 2012.

(Note. – Some Abdominal Imaging and Intervention faculty research is described in other Sections of the Departmental review.)

Teaching

The Abdominal Imaging and Intervention Section offers educational programs at all levels, medical students, residents, fellows, and post graduates. On site, and largely focused to residents and fellows, the Sections' educational offerings include a daily, 30-60 minute conference (often beginning at 7:30am), dedicated seminars and lectures, journal clubs, work rounds, uniquely designed "selective" trainee rotations, active participation in several multidisciplinary conferences, and a highly functional Section intranet called, 'All SharePoint'. The Section's intranet is a comprehensive, web-based source for all operational and educational information related to the Section - general information, schedules, policies, procedures, protocols, curricula, references, and other teaching materials can all be found on the site. The Section is frequently praised for its dedication to resident education; six Abdominal Imaging and Intervention faculty have received the Department's annual award for resident teaching.

The Abdominal Imaging and Intervention Fellowship is one of only a handful of ACGME-accredited fellowships in the country. Although there is currently no match program in abdominal radiology, most applicants to whom the Section offers a position accept the offer. In addition to the outstanding reputation of BWH Radiology, the strengths of the ACGME-accredited All Fellowship Program vocalized by applicant include the MRI and IR emphasis in the curriculum, and the 'palpable' devotion to education that the faculty display to the Fellows each year. The Fellowship program includes an active research component; since 2003, abdominal fellows have

authored or co-authored 77 publications. In addition to participating in both local and national post-graduate courses, two Harvard CME-based Abdominal Imaging and Intervention observerships (general abdominal imaging and intervention, and tumor ablation) offer medical students, non-BWH residents, and post-graduates a unique opportunity to train in the Section.