

## Fall 2016

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### A Message from the President

Patrick M Colletti, MD



Much of the effort for many medical organizations must be focused on budgets, recruitment, and retention of membership as well as the collection of membership dues. If the Correlative Imaging Council is able to retain 150 members at \$20 per member, that projects to \$3000 plus \$1000 from the Walter Wolf Award for Council income. As the Walter Wolf award is paid annually to the presenter of the best correlative imaging presentation, that leaves \$3000 for expenses for SNMMI staff support, intern travel, food, and of course, our mission to:

- Establish and maintain an organization of members with an interest in correlative imaging and clinical practice for the purpose of providing a forum and a mechanism, whereby relevant basic science and clinical practice information may be discussed and disseminated.
- Provide a mechanism for the promotion and encouragement of correlative imaging and clinical practice research and development.
- Provide a source of information relating to correlative imaging and clinical practice affairs to the Society of Nuclear Medicine and Molecular Imaging.

Given the CIC's greatest success in the creation and presentation of CT and MRI Case Conferences at SNMMI meetings, these key educational activities could not be completed without direct support from the SNMMI budget. As this situation is shared by most councils, successfully supported projects have required council partnerships. An example of this was the "Imaging in Pulmonary Embolism" session cosponsored by the CIC and the General Nuclear Medicine Councils during the SNMMI meeting in San Diego.

It is reassuring that SNMMI leadership recognizes the value added by CIC CT and MRI courses, and in fact, SNMMI is investigating recruiting and sponsoring the June 2017 MRI courses in Denver.

Hopefully, CIC will be able to continue to co-sponsor CT and MRI courses in future years.

## CIC Sponsored Sessions at the 2016 SNMMI Annual Meeting in San Diego, CA:

The Correlative Imaging Council (CIC) was pleased to sponsor the following categorical session and continuing education sessions at the June 2016 SNMMI Annual Meeting in San Diego, CA. All of the sessions were well attended.

### Categorical Session:

- Practical PET/CT
- Theranostics Beyond Neuroendocrine Tumors: Novel Applications of Targeted Radionuclide Therapy in Malignant and Nonmalignant Conditions
- Imaging and Therapy of Neuroendocrine Tumors
- Molecular and Multimodality Imaging in Cardiovascular Disease

### CE Sessions:

- Response Assessment for Lymphoma
- Multi-modality Imaging of Common and Uncommon Hepatic Lesions
- An overview of Imaging-Based Response Assessment
- SPECT/CT Quantitation: Now That We Have It What Do We Do With It?
- FDG-PET/CT Evaluation of Pediatric Malignancies
- Imaging for Pulmonary Embolism: A Current Status Report
- Evaluation of Common Pediatric Genitourinary Disorders
- Imaging Prostate Cancer
- Case Review - CT Abdomen and Pelvis (Cases 1 - 13)
- Case Review - MRI Abdomen and Pelvis (Cases 14 - 25)
- Case Review - CT Neuro (Brain/Head and Neck) (Cases 26 - 38)
- Case Review - MRI Neuro (Brain/Head and Neck) (Cases 39 - 50)
- Case Review - CT Chest with Cardiac CTA (Cases 51 - 63)
- Case Review - MRI Chest with Cardiac MRI (Cases 64 - 75)
- Case Review - CT MSK with Spine (Cases 76 - 88)
- Case Review - MRI MSK with Spine (Cases 89 - 100)

## Correlative Imaging Council Walter Wolf Young Investigator Award



Each year, the CIC awards the Walter Wolf Young Investigator Award. This award recognizes a young investigator for originality, scientific methodology, and overall contribution to Molecular Imaging or Therapy through original research showing the importance and value of correlative imaging in all fields of medicine.

The 2016 Walter Wolf Award Recipient is **Dr. Yong-il Kim** for the abstract titled *“Prognostic Value of Pre-treatment Ga-68-RGD PET-CT in Predicting Disease Free Survival in Patients with Breast Cancer: A Comparison Study with Dynamic Contrast Enhanced MRI.”* Congratulations Dr. Kim!

Dr. Amol Takalkar, CIC President, presents Dr. Kim with the CIC Walter Wolf YIA Award.

## CT Appearance of Solid Pancreatic Lesions

Yoan Kagoma, MD

### **Imaging Technique:**

Accurate assessment of solid neoplastic pancreatic lesions requires high-quality dual-phase (arterial and portal venous phase) intravenous contrast enhanced CT. Arterial phase imaging at 20-40 seconds typically provides the best tumour and peri-pancreatic artery delineation (since most tumours are adenocarcinoma and hypovascular) while portal venous phase imaging at 50-70 seconds is typically optimal for identifying liver metastases and assessing the peri-pancreatic veins.

### **Pancreatic Adenocarcinoma (PAC):**

PAC is an epithelial tumour arising from the exocrine pancreas. It accounts for over 95% of solid pancreatic lesions with an incidence of approximately 1-10/100 000 in developing countries. Around 80% of cases arise in patients 60-80 years old. There is a 5-year survival rate of <5% and 3.5 month median survival without surgical treatment.

The majority (up to 60%) of these lesions arise in the pancreatic head and are hypo-intense on arterial and portal venous phase images. Tumour margins are often ill-defined with retroperitoneal extension. In up to 10% of cases, the pancreatic mass is not well seen since it may be isointense to adjacent tissue. Secondary signs of a pancreatic head mass include dilatation of the pancreatic and common bile ducts with abrupt cut-off at the site of the mass (the double-duct sign), atrophy of the distal pancreas due to chronic duct obstruction, an abnormal contour of the pancreatic parenchyma, and/or soft-tissue encasement of adjacent vessels or organs. Distant sites of metastases commonly include the liver or lungs.



**Figure 1: Hypo-intense pancreatic mass with ill-defined margins and duct dilation.**

### **Pancreatic Neuroendocrine Tumour (PNET):**

Classified as an endocrine lesion, these tumours are thought to arise from pluripotent endothelial cells. Representing 1-5% of pancreatic tumours, PNETs are sub-divided into functioning (clinical findings associated with hormone overproduction) and non-functioning tumours. Functioning tumours typically present with smaller sizes due to clinical symptoms associated with hormone overproduction such as hypoglycemia in insulinomas. Non-functioning tumours present with larger sizes and mass effect. The likelihood of malignancy increases with size (>5 cm) and nearly 90% of non-functioning tumours are malignant at presentation.

On CT, PNETs are generally well circumscribed. They demonstrate avid-contrast enhancement in the arterial phase due to their rich vascular supply but may be hyper-, iso-, or hypo-intense on portal venous phase images. Functioning tumours are usually <3 cm in size and non-functioning >5 cm at presentation. Other distinguishing features include necrotic/cystic degeneration and calcifications, especially in larger tumours. Ductal obstruction and parenchymal atrophy are less common than in PAC. Additionally, PNETs are more likely to infiltrate vessels with tumour thrombus formation.

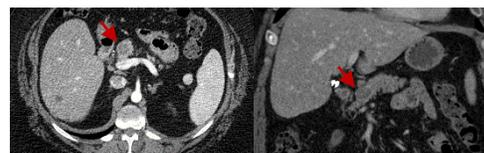


**Figure 2: Avidly enhancing circumscribed pancreatic mass in the arterial phase, which is isointense in the portal venous phase.**

### **Solid Pseudopapillary Tumour (SPT):**

Previously known as a solid cystic papillary epithelial tumour, a papillary cystic tumour, or solid and cystic tumour, SPT is an epithelial exocrine tumour representing 1-2% of pancreatic tumours. More common in females (9:1) and younger adults, this tumour is typically seen in patients aged 25-35 years, has a low malignant potential and presents with metastases in <10% of cases.

On CT, these tumours are well-circumscribed large masses (>9 cm) with a hypo-intense fibrotic pseudocapsule. Heterogeneous peripheral enhancement may be seen in the arterial phase with non-uniform enhancement thereafter. A location in the pancreatic tail is common. Other distinguishing features include internal hemorrhage and cystic degeneration with fluid-fluid levels due to a tenuous vascular supply. This tumour is not usually associated with duct dilatation.



**Figure 3: Heterogeneous pancreatic mass. Note the lack of ductal dilation.**

### **Metastases:**

Metastases represent 2-5% of malignant pancreatic tumours. The most common primary tumours that metastasize to the pancreas include renal cell carcinoma (RCC), lung cancer, breast cancer, gastric cancer, colorectal cancer, and melanoma. Of note, lymphoma may arise from peri-pancreatic lymph node invasion. Nearly 30% of patients present with disseminated disease.

On CT, a solitary pancreatic lesion is seen in up to 70% of cases; however multifocal or diffuse disease is also possible. The CT appearance mimics the characteristics of the primary tumour (e.g. hypervascular in RCC or hypovascular in lung cancer) which leads to a myriad of appearances. The most helpful differentiator is a history of malignancy elsewhere.

### **Intrapancreatic Splenule:**

Ectopic splenic tissue occurs due to inadequate fusion of the splenic anlage. It has been reported in 10-30% of autopsies. The majority of cases are asymptomatic. The pancreatic tail is the second most common location.

On CT, most cases are 1-3 cm in size, located within 3 cm of the pancreatic tail along the dorsal pancreatic surface, and are incompletely surrounded by pancreatic tissue. They are ovoid in appearance and mimic the enhancement of the spleen on different contrast phases. Often, the nodule will show greater enhancement than the adjacent pancreatic tissue.



**Figure 4: Classic location and enhancement of an intrapancreatic splenule.**

### **Pancreatitis:**

Pancreatitis can mimic the radiologic appearance, histology, and clinical symptoms of adenocarcinoma. These similarities can make distinguishing the two entities very difficult. Furthermore, adenocarcinoma can be associated with inflammation and with chronic pancreatitis.

On CT, focal pancreatitis is often hypo-intense to adjacent pancreatic parenchyma. Some helpful signs to identify pancreatitis include a smoothly tapering or non-dilated pancreatic duct, which courses through the mass. Coarse calcifications are associated with chronic pancreatitis, which may also be helpful for the purposes of characterization.

### **Bibliography:**

- Goodman GM, Willmann JK, Jeffrey RB. (2012). Incidentally discovered solid pancreatic masses: imaging and clinical observations. *Abdominal Imaging*, 91-97.
- Hamilton S, Aaltonen L. (2000). Chapter 10: Tumours of the exocrine pancreas. In *World Health Organization Classification of Tumours. Pathology and Genetics of Tumours of the Digestive System*. Lyon: IARC Press.
- Low G, Panu A, Millo N, Leen E. (2011). Multimodality Imaging of Neoplastic and Non-neoplastic Solid Lesions of the Pancreas. *RadioGraphics*, 993-1015.
- STATDx. Solid Pseudopapillary Neoplasm, Pancreatic Ductal Carcinoma, Pancreatoblastoma, Pancreatic Metastases and Lymphoma.

## **Nuclear Medicine and Medical Student Education**

**Joshua Durbin, MSc., 4<sup>th</sup> year medical student, Queen's University, Ontario, Canada**



Throughout their pre-clinical education, medical students are provided with a vast number of resources from a wide variety of platforms, including but not limited to JAMA and NEJM review articles, selections from Harrison's and other voluminous texts, and lecture resources enumerating thousands of PowerPoint slides. From my observations, one thing remains clear – the more engaging the resource, lecturer, or topic, the faster and more comprehensive our understanding is of the material.

The current cohort of medical students is an adaptable group of technology connoisseurs – In general, we have not only grown up with, but have also had our attitudes and opinions shaped by electronic resources. All one has to do is walk through a Canadian medical school to see

that encyclopedias and medical dictionaries have been replaced by Wikipedia and #FOAMed (free open access “meducation”). We save electronic versions of our journal papers, take notes on electronic media, and roll our eyes when professors dust off transparencies and overhead projectors. We want lecture slides in advance of the lecture, study on our cell phones, tablets, and computers, and marvel at the newest forms of technology. We learn from YouTube lectures, read the news on our RSS feeds, and ask questions through emails, Twitter, and Facebook. We rapidly adapt to and utilize new technologies, share resources and notes electronically, and have become more and more apprehensive to antiquated resources. We are technology consumers, and our appetite is never-ending.

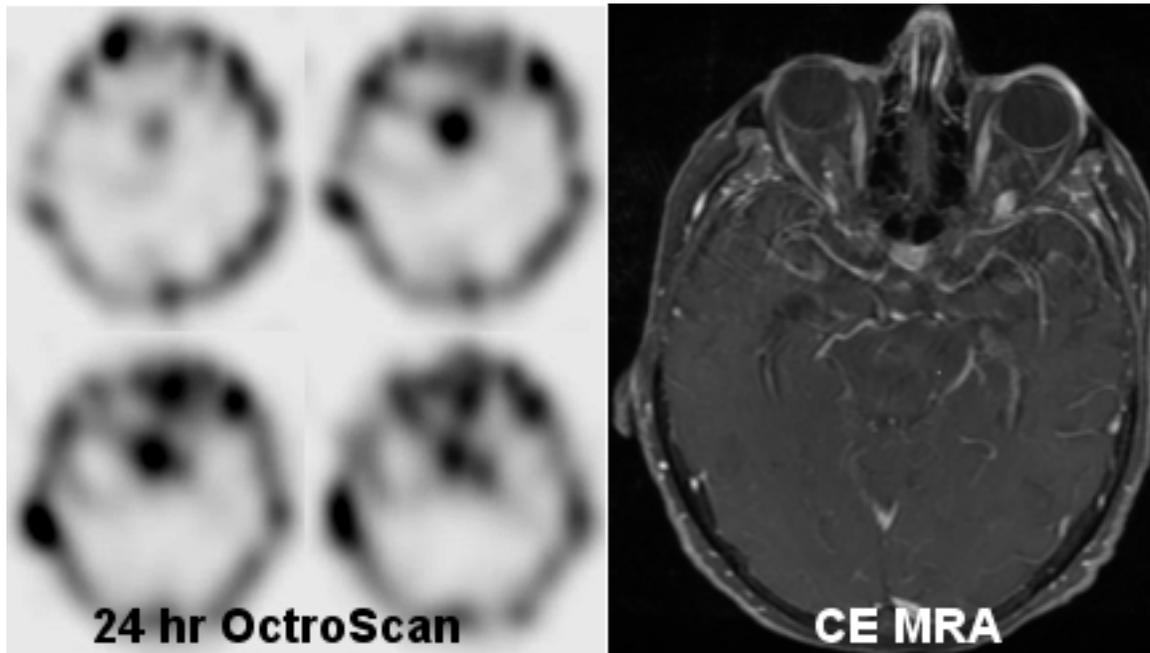
Nuclear Medicine and the wide array of its applications appeals to this tech-savvy group of students. We learn gross anatomy through cadaveric studies, and learn coronary dominance through diagrammatic representation. From my experience, while Netter’s was traditionally the bread and butter for the anatomist, the 3D views presented in Zygote Body (formerly Google Body) provide an unparalleled perspective of physical spatial relationships. We learn myocardial infarction and vascular territories through pictorial schematics. Given the ongoing shifts towards digital learning mediums, why not teach or supplement these topics through 3D cardiac perfusion studies to provide the most up-to-date and graphically engaging images? These are the studies that we will order, perform, analyze, and utilize while providing patient care and this would additionally provide us with both early and broad exposure. These studies could be used not only to complement “traditional” medical education, but could represent a new way of presenting anatomical and physiological processes and relationships to our eager fingertips.

Anatomy may represent the lowest hanging fruit for the introduction of nuclear medicine studies. The current level of exposure to Nuclear Medicine is limited to basic introductions to the concepts of bone scans and thyroid uptake, but little else. However, there is no shortage of physiological processes that may be taught through supplementation with nuclear studies. For example, the concept of the sentinel node and lymphatic spread could be taught through the use of hybrid imaging, and metabolomics could be demonstrated through increased radiotracer uptake in inflammatory processes. There are a multitude of physiological processes that could be highlighted in this way, providing unique opportunities to mate nuclear medicine imaging studies and therapies with primary medical education.

In a world shaped by technology, and with a cohort of students who are eager to devour the newest gadgetry, there exists a void that is ripe for filling. The beautiful elegance of nuclear medicine and the images it provides are engaging, interesting, and burgeoning. A greater understanding of the types of studies that we may order will enhance our clinical acumen and understanding of complex physiology – and we’ll look cool in the process. In short, nuclear medicine can help teach our malleable young minds where the limits of our current technologies are so we may dream beyond them, potentiating and securing our understanding of the future of cutting edge science, medicine, and technology.

**Case Study**  
**Patrick M Colletti, MD**

This 56-year-old woman has a 2-year history of treated urothelial cancer. She now is presenting with headaches. What is the most likely diagnosis?



- A. Macroadenoma
- B. Meningioma
- C. Metastasis
- D. Sarcoidosis

In this case, all of the choices may be possible. While Macroadenoma (A) may accumulate  $^{111}\text{In}$ -octreoscan, (A) is less likely as octreoscan uptake is typically less in macroadenomas than in meningiomas and the sellar lesion appears to enhance more than the typical adenoma, and it appears to have a dural tail.

Metastasis (C) is the least likely of the choices to demonstrate significant  $^{111}\text{In}$ -octreoscan uptake.

Sarcoidosis (D) of the sella could have both nodular enhancement on MRI and  $^{111}\text{In}$ -octreoscan uptake, but this is not the best response, as meningioma of the sella is a much more common condition than sarcoidosis.

Thus, the best response is Meningioma (B). Meningiomas typically enhance strongly and retain contrast agent on delayed imaging. In addition, most meningiomas are  $^{111}\text{In}$ -octreoscan avid, more so than macroadenomas.

In this case, the patient's headaches resolved, and the  $^{111}\text{In}$ -octreoscan was particularly helpful, as the results made metastatic disease to sella most unlikely.

References:

Maini CL, Tofani A, Sciuto R, et al: Somatostatin receptors in meningiomas: a scintigraphic study using 111-In-DTPA-D-Phe-1-octreotide. Nucl Med Comm 14:550, 1993.

Schmidt M, Scheidhauer K, Luyken C, et al: Somatostatin receptor imaging in intracranial tumors. Eur J Nucl Med 25:675, 1988

## Save the Date!

The Correlative Imaging Council will be co-sponsoring the following *continuing education sessions at the 2017 SNMMI Mid-Winter Meeting in Phoenix, Arizona*

### **January 19 - 1:15-3:15 PM**

Imaging of Prostate Cancer (joint session with CMIIT)

CT and MRI Case Review

### **January 20 - 12:45-2:45 PM**

Amyloid and tau imaging: role of quantification (joint session with BIC)

CT and MRI Case Review

### **January 21 - 7:45-9:45 AM**

Monitoring Tumoral Response (joint session with PET CoE & PIC)

## Tips for your visit to Phoenix Arizona in January!

### **Katherine Zukotynski, MD and Samuel Almodóvar, MD**

Phoenix is the capital of Arizona and the 6<sup>th</sup> largest city in the United States of America. The city spans more than 500 square miles with a population of more than 1.4 million residents. With over 41,000 acres of mountain parks and desert preserves, five 18-hole championship golf courses and several cultural centers, there is lots to do and see!

### **A few things to keep in mind:**

**Phoenix Area Food Scene:** This active metropolis has extensive culinary options, with favorites including Southwestern and Mexican eateries, as well as local steak houses. Many restaurants have menus inspired in the fusion of two or more cultures, providing creative and interesting combinations of flavors. Vegan and vegetarian options are offered at many establishments. The flagship hotel for the upcoming Mid-Winter Meeting will be the Arizona Grand Resort, which has several dining options. These include: Rustler's Rooste (a steakhouse with Old West atmosphere), Aunt Chilada's (an authentic Mexican restaurant), The Lobby Grill (a casual grill), The Market Place Cafe (a café serving to-go meals, coffee and gelato), the Caribbean-themed Lobby Bar and the poolside Oasis Bar and Grill. The resort offers shuttle service to the nearby Arizona Mills shopping center, which offers many dining options and an ample selection of stores. There are additional eateries outside of the property, within easy access. For those interested in specific restaurant suggestions, you can check some of the many on-line sources. Here is a [link](#) to a list of restaurant recommendations in Phoenix by 10 Best-USA Today.

**Phoenix is home to the Pueblo Grande Museum and Archeological Park:** a 1,500 year-old Hohokam village and National Historic Landmark. Starting January 19<sup>th</sup> and recurring monthly on the 3<sup>rd</sup> Thursday of the month you can take a behind the scenes tour.

**Scottsdale Art Walk/Downtown Chandler Art Walk:** Scottsdale is rich in art galleries and a place that inspires many artists. On January 19<sup>th</sup> between 7-9pm along 7100 East Main St. (Scottsdale Art Walk) and January 20<sup>th</sup> between 6 and 10pm along Boston and San Marcos Streets (Chandler Art Walk), enjoy a walk, see the local art and hear live music.

**Arizona Biltmore Resort & Spa:** Opened in 1929 and built by Albert Chase McArthur, this is the only surviving hotel in the world Frank Lloyd Wright helped to design. Of note, Harpo Marx and his bride honeymooned here as did Ronald and Nancy Reagan.

**A few side-trips and activities– time permitting:** Phoenix enjoys pleasant temperatures in late January that are great for outdoor activities. If you have the extra time and enjoy hiking, Camelback Mountain in the Phoenix metropolitan area offers trails with panoramic views of the city. Golf is very popular in the area and there are plenty of golf courses where you can enjoy the sport. Arizona has a spectacular landscape that ranges from deserts to man-made lakes, with the Grand Canyon being at the top of the list. For those planning to stay a few extra days, you might consider a trip to Sedona to enjoy its characteristic red rock formations, relaxing on the shores of Lake Powell, exploring Canyon de Chelly National Monument or admiring the splendor of Grand Canyon National Park, a UNESCO World Heritage Site.

Please visit the CIC [website](#) for more information on the CIC and upcoming events.