Cardiology

Scientific Paper 22: “Coronary vascular dysfunction and prognosis in patients age 75 and older”

- Key Findings: Many older adults have preserved coronary vascular function and are much less likely to die from cardiac causes compared to those with abnormal coronary vascular function. This suggests that loss of vascular function may not be an inevitable consequence of aging.

- Importance: The research offers insights into the aging process and may serve as a method for investigating why some people have worsening coronary vascular function as they age and others do not.

- What It Means for Patients: This research will help to better identify high risk patients who may need more aggressive medical therapy or, in some cases, invasive coronary angiography.

Scientific Paper 86: “Adding CFR improves diagnostic accuracy of 13N-ammonia PET MPI to detect CAD”

- Key Findings: N-13 ammonia positron emission tomography/computed tomography (PET/CT) myocardial perfusion imaging provides can be used to quantify maximum coronary flow reserve, which adds substantial diagnostic value for detection of coronary artery disease (CAD).

- Importance: This research strengthens the value of coronary flow reserve in PET/CT cardiac imaging and improves decision-making towards conservative or invasive treatment of CAD.

- What It Means for Patients: Physicians be even more accurate and even better identify patients with CAD allowing a step towards cost-efficient personalized medicine.

Scientific Paper 350: “Adaptive servo-ventilation therapy can improve cardiac sympathetic nerve activity, cardiac function, exercise capacity and symptom in chronic heart failure patients”

- Key Findings: Adaptive servo-ventilation (ASV) is just as effective as conservative treatments in improving chronic heart failure symptoms and cardiac function as well as increased exercise capacity and sympathetic nerve activity in cardiac patients.

- Importance: Many chronic heart failure patients struggle with not just strenuous activity but even the essentials such as moderate exercise and normal breathing. ASV energizes the heart by increasing activity in the sympathetic nervous system.
• What It Means for Patients: ASV is an effective alternate treatment for congestive heart failure patients.

General Clinical Specialties

Scientific Paper 202: “Overall survival of patients with differentiated thyroid cancer: Comparison with that of the normal population”

• Key Findings: Patients with differentiated thyroid cancer live as long as people in perfect health, unless they are in the minority and have reached the most advanced stages of disease.

• Importance: This research is the first of its kind to compare differentiated thyroid cancer patients to a normal healthy population. Its findings highlight the excellent diagnostic and therapeutic strategies for these patients.

• What It Means for Patients: Patients with differentiated thyroid cancer in stages I-IVa who receive radioiodine therapy could be considered healthy patients after treatment.


• Key Findings: After molecular imaging, about 36 percent of neuroendocrine cancer patients had a change in their management plans.

• Importance: Molecular imaging provides valuable information for a treatment plan that can help identify operable and curable symptomatic patients or spare patients from futile surgery.

• What It Means for Patients: Treating physicians can develop a clinical treatment plan best suited to their situation with a single investigation.

Instrumentation and Data Analysis

Scientific Paper 209: “Total radiation dose reduction in multiple session dynamic brain PET study using single CT scan”

• Key Findings: One CT scan is enough to provide anatomical images to support more than one PET scan.

• Importance: Awareness of medical radiation exposure has increased over the past several years. The concern of additional radiation dose associated with CT in PET/CT is magnified in scans performed for investigational purposes

• What It Means for Patients: This approach would reducing the potential hazards of radiation in many basic investigations and diagnostic examinations using brain PET/CT, in which several head CT scans are performed.
**Scientific Paper 106: “Four-dimensional PET image reconstruction with respiratory and cardiac motion compensation from list-mode data”**

- Key Findings: PET 4D image reconstruction with compensation of both cardiac and respiratory motion can significantly improve the cardiac PET image quality, i.e., enhance PET image resolution without amplifying the image noise, by 15 percent.

- Importance: Previous studies have compensated for either cardiac or respiratory motion in image reconstruction, but this research is the first viable reconstruction of a PET image with compensation for both cardiac and respiratory motion using all the PET data.

- What It Means for Patients: Patients can receive the same diagnostic accuracy with less radiation exposure and less scan time.

**Molecular Targeting Probes**

**Scientific Paper 586: “Evaluation of NaF PET/CT, FDG PET/CT, combined NaF/FDG PET/CT and CT alone for detection of bone metastases”**

- Key Findings: Composite NaF and FDG PET/CT images can identify more bone metastases than the other techniques, such as CT alone, NaF PET and FDG PET.

- Importance: The combined use NaF and FDG PET/CT provides a multilayered view of the biological processes involved in tumor growth in bone.

- What It Means for Patients: The combined administration of 18F NaF and 18F FDG in a single PET/CT scan has the potential to improve patient convenience and diagnostic accuracy, while reducing healthcare costs.

**Scientific Paper 74: “In vivo monitoring of survival and proliferation of hair stem cells in hair follicle regeneration animal model”**

- Key Findings: Molecular imaging techniques can non-invasively visualize the fate of the implanted stem cells and monitor the survival, death and proliferation during new hair follicle formation in an animal model.

- Importance: This is the first study of hair follicle regeneration using an in vivo molecular imaging technique which could be an effective tool for evaluating hair regeneration therapies.

- What It Means for Patients: Hair regeneration using hair stem cells is a promising therapeutic option emerging for hair loss, and molecular imaging can speed up the development of this therapy.

**Neurology**

**Scientific Paper 198: “The impact of dopamine on aggression: An [18F]FDOPA PET study”**

- Key Findings: Individuals with lower dopamine levels are more likely to be aggressive when provoked in competitive situations.
• Importance: This is the first investigation which was able to show this association between dopamine levels and aggression in the living human brain.

• What It Means for Patients: In the future, there may be more individualized treatment strategies for aggression.

Scientific Paper 412: “Disrupted adenovirus-based anti-cocaine vaccine: Assessment of efficacy based on PET dopamine transporter (DAT) imaging and cocaine challenge”

• Key Findings: Molecular imaging, based on a dopamine transporter (DAT) PET scan, can provide objective proof that an investigative vaccine works as a treatment for cocaine addiction.

• Importance: An inoculation against this and other addictions could potentially save lives and cut down on the money and time people spend trying to quit.

• What It Means for Patients: A vaccine to eliminates an addict’s ability to get high from cocaine could be available in the future.

Scientific Paper 250: “Metabolic tumor volume by 18F-FDOPA PET is predictive of treatment response in patients with recurrent high-grade gliomas on anti-angiogenic therapy as early as 2 weeks after therapy initiation”

• Key Findings: Patients with gliomas who responded positively to treatment, as evidenced with F-18-FDOPA PET imaging, lived three times longer than those who responded poorly (from the start of treatment).

• Importance: In a disease that is so malignant that patients only have a life expectancy of one year, molecular imaging can tell whether a treatment is effective or not.

• What It Means for Patients: PET imaging with amino acids can be used to predict survival and to assess the effectiveness of new treatments more quickly.

Scientific Paper 148: “A two-year longitudinal assessment of Aβ deposition in MCI with 18F-Florbetaben”

• Key Findings: Individuals who showed high levels of biomarker binding during imaging and atrophy of the hippocampus, the memory center, had an 80 percent chance of developing Alzheimer’s disease within two years.

• Importance: Diagnosis of Alzheimer’s disease can now be made when the patient first presents with symptoms and still has largely preserved mental function.

• What It Means for Patients: Earlier diagnosis may give the patient several years to prepare for dementia while they still have control over their destiny.

Scientific Paper 299: “Imaging and cognitive biomarkers as predictors of progression to Alzheimer’s disease”
• Key Findings: Widespread amyloid plaque build-up precedes cognitive impairment, and those with extensive amyloid burden are at high risk of cognitive decline.

• Importance: This is among the first studies to focus on beta amyloid presence in healthy patients.

• What It Means for Patients: Earlier diagnosis may give the patient several years to prepare for dementia while they still have control over their destiny.

Scientific Paper 300: “Beta-amyloid burden alters Default Mode and Salience Network connectivity related to impaired cognition in healthy adults”

• Key Findings: The presence of beta amyloid, even in a very healthy group of individuals, has a negative impact on cognition itself, and impairs brain connectivity.

• Importance: PET imaging of beta amyloid is likely to be one of the key predictive markers for incipient Alzheimer’s disease, and thus may be one of the most important molecular imaging tools in both clinical research and in the diagnosis and (ultimately) treatment of patients with cognitive decline associated with Alzheimer’s disease.

• ‘What It Means for Patients: Early diagnosis will maximize the effectiveness of most treatments, and would allow patients to adjust their life plans to deal with significant changes in brain function before their cognitive abilities have been so degraded that they no longer have the ability to make such adjustments.

Scientific Paper 91: “Visual assessment of 11C-PiB PET and 18F-FDG PET for detection of amyloid burden and abnormal metabolism among cognitively normal middle-aged adults with high risks for Alzheimer’s disease”

• Key Findings: C-11 PiB amyloid imaging is a better means of evaluating amyloid patterns in the brain than F-18 FDG imaging.

• Importance: With molecular imaging physicians can evaluate whether pathological changes associated with Alzheimer’s disease are happening many years before onset of significant clinical symptoms.

• What It Means for Patients: If patients were aware that they would develop Alzheimer’s disease in the future they can plan accordingly.

Oncology – Basic


• Key Findings: Phosphorus-32 is a customized patch treatment for basal cell carcinoma completely that destroys facial tumors without surgery or major radiation therapy in 80 percent of patients studied.
• Importance: The skin patch may become the standard procedure for treating basal cell carcinoma or serve as an alternative when surgery and radiotherapy are not possible.

• What It Means for Patients: For patients, the skin patch is beneficial because it is a simple, inexpensive and convenient procedure that does not require them to be admitted to the hospital.

Scientific Paper 222: “Radium-223 chloride: Radiation safety, tolerability, and survival gain in patients with castration-resistant prostate cancer (CRPC) and bone metastases”

• Key Findings: Patients who received Radium-223 chloride as a treatment for castration-resistant prostate cancer lived an average of three months longer than those who received a placebo.

• Importance: Radium-223 offers a completely new approach to the treatment of bone metastases as systemically treats multiple sites of disease simultaneously.

• What It Means for Patients: This treatment offers a new standard of care for patients with advanced prostate cancer. It is usually very well tolerated and serious side effects are unusual.

Oncology – Clinical


• Key Findings: Timing of when bevacizumab is delivered to renal cell carcinoma patients is critical in determining how effective the treatment will be. Early PET/CT response assessment identifies patients where this treatment is most effective.

• Importance: This research provides more evidence that early and close monitoring of the patient with PET/CT during the first phase of a patient’s course of treatment can increase the predictive value of these response assessments, as well as potentially tailor more aggressive treatment for non-responsive patients.

• What It Means for Patients: The information gathered may be utilized in the future to optimize therapy, allowing physicians to modify therapy in those patients who show poor response based on PET/CT findings.

Scientific Paper 569: “Predictive role of FDG PET-CT in monitoring locally advanced rectal cancer (LARC) during preoperative radiochemotherapy with an experimental bevacizumab schedule”

• Key Findings: Timing of when the radiochemotherapy drug bevacizumab is delivered to rectal cancer patients is critical in determining how effective the treatment will be. Early PET/CT response assessment identifies patients where this treatment is most effective.

• Importance: The rate of complete pathological response of rectal cancer patients to anticancer therapy—as determined at surgery—was higher than reported in most studies,
which shows improvements in the use of available cancer drugs.

- **What It Means for Patients:** Early and close monitoring of the patient with PET/CT during the first phase of a patient’s course of treatment can predict their response to the treatment. It could also potentially be used to tailor more aggressive treatment for non-responsive patients.