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BOOK OF ABSTRACTS

RÉSUMÉS

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001

EVALUATION OF SONOGRAPHICALLY SUGGESTED CASES OF HEPATIC HEMANGIOMA BY TC-99M RBC SCINTIGRAPHY

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Hepatic hemangiomas are the most common liver lesions accounting for nearly 5-7% of all benign tumors. Differentiation of hepatic hemangiomas from malignant tumoral lesions and metastases by a non-invasive method is very important. The ultrasonographic appearance of hepatic hemangioma is not specific whereas, Tc-99m RBC scan is a simple, non-invasive well practiced diagnostic modality. It is extremely helpful for confirmation or exclusion of hepatic hemangiomas. In this study 110 cases of sonographically diagnosed cases of hepatic hemangioma were studied in NINMAS, Dhaka from July 2014 to June 2015. The purpose of this study was to demonstrate the most important advantages of Tc-99m RBC Scintigraphy over ultrasonography in diagnostic evaluation of hepatic hemangioma. In this study it was revealed that among 110 sonographically suggested hepatic hemangioma cases, 66 cases were true positive. Among the patients with <50 years, total 52(69%) patients were true positive for hepatic hemangioma whereas among the patients with ≥50 years, total 14(40%) patients were true positive for hepatic hemangioma. There was significant association between female patients and hepatic hemangioma (p value <0.001). Among 110 sonographically suggested hepatic hemangioma cases the proportion of RBC scan positive cases was 60% with 95% Confidence Interval (CI) of 57.16-74.84.

Introduction: Hemangioma is the most common benign hepatic tumor and second most common neoplasm of the liver, following intrahepatic metastases. They are most common in people in their third to fifth decade of life. Women, especially with a history of multiparity, are affected more often than men. The female-to-male ratio is 4:1 to 6:1. The course of hemangioma is usually uncomplicated, differentiation from other lesions, such as metastases, is essential to avoid unnecessary or risky examination and treatment. Ultrasonogram is sensitive but not specific for evaluating hepatic hemangioma. Using CT, there is some evidence that metastatic lesions and hepatoma may have an appearance similar to that of hemangioma. Although MRI plays an important diagnostic role but relatively expensive to perform. Tc-99m RBC imaging is non-invasive, economical, easily performed and relatively specific method for detection of hepatic hemangioma. Tc-99m RBC Scintigraphy continues to play a unique role in the evaluation of hepatic masses. When confronted with clinical data and a preliminary radiologic study suggestive of hemangioma, Tc-99m RBC Scintigraphy should probably be the initial diagnostic examination. Most of the cases Tc-99m RBC scan positive cases requires only follow up, whereas RBC Scan negative cases requires further evaluation for definite diagnosis and clinical management. This study is aimed to evaluate the effectiveness of Tc-99m RBC imaging for the confirmation or exclusion of hepatic hemangioma in the context of Bangladesh and thus reduce mortality.

Methods: An observational descriptive cross sectional study, made on 110 sonographically suggested hepatic hemangioma cases in National Institute of Nuclear Medicine and Allied Sciences (NINMAS) were studied. Hepatic hemangioma with tumor size <2cm and pregnant women were excluded from this study

Results: In this study it was revealed that among 110 sonographically suggested hepatic hemangioma cases, 66 cases were true positive for hepatic hemangioma done by Tc-99m RBC Scintigraphy. There was a significant difference between 2 different age in RBC Scan positive cases of hepatic hemangioma (p value <0.001). Among the patients with <50 years, total 52(69%) patients were true positive for hepatic hemangioma whereas among the patients with ≥50 years, total 14(40%) patients were true positive for hepatic hemangioma. There was significant association between <50 years and hepatic hemangioma (p value <0.001). (Table I).

Age (In year)	RBC scan positive cases of HH*		RBC scan negative cases of HH		Total number of Patients
	No. of patients	%	No. of patients	%	
< 50	52	69	23	31	75



≥ 50	14	40	21	60	35
Total	66	44	110		

Table I:

*Two sample proportion test was done to measure the level of significance.

A statistically significant difference in risk of hepatic hemangioma was observed in analysis for patients of male versus female (p value 0.001). It was observed that among the male patients, total 15(35.7%) patients were RBC scan positive for hepatic hemangioma whereas among the female patients total 51(75%) patients were RBC scan

Sex	RBC scan positive cases of HH		P value*
	Total no of patients	Percentages	
Male	15	35.7	< 0.001
Female	51	75	

positive for hepatic hemangioma. There was significant association between female and hepatic hemangioma (p value <0.001). (Table II)

Table II:

*Two sample proportion test was done to measure the level of significance.

Among 110 sonographically suggested hepatic hemangioma cases the proportion of RBC scan positive cases was 60% with 95% Confidence interval (CI) of 57.16-74.84. (Table III).

Sonographically suggested hepatic hemangioma cases	RBC scan positive cases	Proportion of RBC scan positive cases (95% CI)
110	66	60% (57.16-74.84)

Table III:



Photograph 1: Sonographically suggestive cases of hepatic hemangioma.

Photograph 2: Tc-99m RBC Scintigraphy positive case of hepatic hemangioma.

Discussion: The course of hepatic hemangioma is usually uncomplicated, differentiation from other lesions, such as metastases, is essential to avoid unnecessary or risky examination and treatment. Ultrasonogram is sensitive but not specific for evaluating hepatic hemangioma. Until recently, biopsy, angiography, and CT scanning with and without contrast enhancement were the most definitive methods for characterizing hemangiomas. All of these procedures are associated with some risk. Using CT; there is some evidence that metastatic lesions and hepatoma may have an appearance similar to that of hemangioma. If strict criteria are used, diagnosis of hemangioma can only be ascertained in 55% to 86%. Both MRI and Tc-99m RBC Scintigraphy have been proposed as alternative methods to characterize hepatic hemangiomas. The MRI technique demonstrated atypical characteristics in one large lesion with extensive fibrosis and in a second case which had recently hemorrhaged. These lesions demonstrate the wide range of appearances of hepatic hemangiomas on MRI. Because of the high sensitivity and



previously reported specificity of the Tc-99m RBC Scintigraphy technique a positive result should usually preclude further diagnostic evaluation.

Among the total of 110 patients, their age range was in between 20 and 79 years with a mean age (\pm SD) of 47.5 (\pm 10.2) years. Patients were divided into 6 groups in this study. The maximum number 32 (29.1%) cases were belonged to the age group 30 to 39 years. Among the 110 patients 42 were male and 68 were female. Male female ratio was 1:1.6. Maximum male patient were in 50-59 age group and female were in 30-39 age group.

Hepatic hemangioma is common in third to fifth decade of life. A study conducted by Jiang et al. who analyzed data from 9 hepatic hemangioma patients over 3 years period from January 2007 to March 2010. In his study the lowest age of patient was 26 years and the highest age was 68 years with a mean age of 48.5 years. Samad et al. conducted his study on 9 patients seen from 1985 to 1992. Their age ranged from 30 to 63 years with the mean 50 years. Schnellendorfer et al. showed that mean age at diagnosis of the 289 patients was 51 ± 11 years with the range 22 to 80 years. In our study, the lowest age of patient with hepatic hemangioma was 26 years and the highest age was 75 years with a mean age of 47.5 (\pm 10.2) years which is similar with the above all studies.

Hashemi et al. showed significant difference in the frequency of hepatic hemangioma in men and women. Out of 38 liver hemangioma patients male patients were 6(15.8%) with 32(84.2%) female patients with a P value <0.001. In our study it was revealed that among the male patients, total 15(35.7%) patients were RBC scan positive for hepatic hemangioma whereas among the female patients, total 51(75%) patients were RBC scan positive for hepatic hemangioma. There was significant differences between male and female in RBC scan positive cases for hepatic hemangioma which is similar with the study conducted by Hashemi et al.

After the performance of Tc-99m RBC Scintigraphy among sonographically suggested cases of hepatic hemangioma 66 out of 110 patients are evaluated Scintigraphically positive and 44 are negative regarding to liver hemangioma. The proportion of RBC scan positive cases was 60% with 95% Confidence Interval (CI) of 57.16-74.84. This result is similar with the study conducted by Khraisat et al. where Tc-99m RBC Scintigraphy was truly positive in 64 out of 96 lesions regarding hepatic hemangioma. The proportion of RBC scan positive cases was 66% with 95% Confidence interval (CI) 56.53-75.46. These findings are also similar to another study conducted by Balci et al. where 15 out of 42 patients were evaluated Scintigraphically negative and 27 were positive regarding to hepatic hemangioma. The proportion of RBC scan positive cases was 64% with 95% Confidence Interval (CI) 49.50-78.

Conclusion: Hepatic hemangioma is the most common benign tumor with a clinical diagnosis of a significant importance. Diagnosis of hepatic hemangioma is sometimes difficult by means of ultrasound. Tc-99m RBC Scintigraphy is very sensitive and specific imaging modality for this kind of lesion. Although lesions less than 1.5cm cannot be detected by Tc-99m RBC Scan as they are beyond the limit of spatial resolution of the gamma camera used, Sensitivity for hemangioma greater than 2 cm in diameter is reported to be as high as 82%, with a specificity of up to 100%. Therefore all patients suspected of having hemangioma liver must undergo a Tc-99m RBC Scintigraphy for better evaluation. Awareness of the diagnostic implication of Tc-99m RBC Scintigraphy in sonographically suggested hepatic hemangioma may aid the selection of the most appropriate treatment option for the patients presented with hepatic hemangioma on ultrasonography.

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002

APYROGENICITY ANALYSIS OF TC 99M DIETHYLENE TRIAMINE PENTAACETIC ACID (DTPA) FOR INTRATHECAL INJECTION

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Objectives: To determine whether prolonged storage of single and multiple punctured fractions of Tc99m DTPA kept at room temperature remains appropriately apyrogenic for intrathecal use <0.14U/V.

Methods: Validity of Gel Clot LAL (PYROGENT™, LONZA) and presence of chelation inhibition were tested. Then, Tc99m DTPA (Draximage) was prepared following in-house protocol for intrathecal injection. A set of samples were fractioned in triplicate from a single puncture and incubated at room temperature for up to 12H. Additional samples were taken in triplicate 30min post first needle puncture and prepared for incubation at room temperature for up to 12H (second puncture). Upon expiry of incubation time; 2H, 4H, 6H, 8H, 10H, 12H, aliquots were drawn and mixed with LAL reagent. The inoculated tubes were placed in a water bath at 37°C ± 1° C for 60min ± 1min with positive (CSE 0.25EU/mL) and negative (LAL Reagent water) controls. Samples testing positive (≥0.25EU/mL) were determined via a gelling whereas samples testing negative (<0.25EU/mL) remained liquid.

Results: Validity testing authenticated the label claim sensitivity of LAL reagent at 0.5EU/mL ± 0.25EU/mL and Tc99m DTPA did not have adverse chelation effects. Both single puncture and double puncture Tc99m DTPA remained appropriately apyrogenic (<0.5EU/mL) until expiry (12H). All positive controls showed gelling post-incubation in water bath and all negative controls showed lack of gelling post-incubation in water bath.

Conclusions: Tc99m DTPA can be considered for intrathecal injection for up to 12 hours post-labelling time. Additionally, a subsequent puncture does not seem to affect the pyrogenicity. Thus, Tc99m DTPA can be compounded at a convenient time prior to usage and used as needed when the patient is booked in advance. An additional dose can be drawn from the stock in case of add-on, dose loss or delayed scheduling.

003

PERCEPTIONS AND KNOWLEDGE OF HEALTH LITERACY AMONG HEALTHCARE PROVIDERS IN A COMMUNITY BASED CANCER CENTRE

Ruvette Coelho, MRT(T), MBA, HBSc, BSc

The Canadian Council on Learning estimates that 60% of Canadian adults and 88% of seniors are health illiterate. There have been a few studies that found relatively low levels of awareness and understanding of health literacy among health care professionals.



The goal of this cross-sectional exploratory study is to contribute to the understanding of health literacy among healthcare providers. It is focussed on ascertaining healthcare providers' perceptions, general knowledge, and understanding of the concept of health literacy, surveying techniques used to facilitate care and education for patients and exploring their understanding of limited health literacy and its management.

Healthcare providers were recruited from a community based cancer centre, which includes medical radiation therapists, radiation oncologists, oncology nurses, social workers, and dietitians. This mixed methods research study consisted of a 23 item web based survey. Quantitative and qualitative analyses revealed that only 50% of the respondents recognized the term health literacy, a third correctly guessed the prevalence of limited health literacy rates in Canada, 45% expected their patients to have a basic understanding of health, and 84% would like more training on health literacy. 84% correctly believed that higher education levels have no impact on an individuals' health literacy. About 75% of the respondents assess patient understanding almost always or often. Respondents outlined barriers to effective assessment which mainly indicated a lack of knowledge or awareness about health literacy.

The study highlighted a lack of awareness and understanding of health literacy which needs to be addressed through continuing education programs and professional development activities; public campaigns to increase awareness, and wide dissemination of reports on health literacy. Health literacy universal precautions need to be adopted and implemented along with specific techniques that can improve patient-centered communication between patients and healthcare providers that can help improve health outcomes.

004

BISPHOSPHONATE RELATED ATYPICAL FEMORAL FRACTURE ON BONE SCAN: IMPORTANCE OF CLINICAL HISTORY

Alaa Bakkari, Owais Kotib, and Wanzhen Zeng

Objectives: Present a case of bisphosphonate related bilateral atypical femoral fractures misdiagnosed on bone scan in a patient with breast cancer. Review clinical, radiological and scintigraphic findings, and possible mechanism of bisphosphonate related femoral stress fractures

Bisphosphonates have been extensively used for the treatment of osteoporosis. Although bisphosphonate related atypical femoral fractures have been increasingly reported, it is not uncommon to misdiagnose femoral fractures in patients with known cancer, as shown in the following case.

A 68-year-old female presented with increasing pain in bilateral thighs. The patient was known to have bony metastases from breast cancer. On the SPECT bone scan, there were skeletal metastases to the sternum, thoracolumbar spine and left hemipelvis, stable for over 11 months. Focal uptake of moderate intensity in bilateral lateral proximal femurs was identified, without significant change compared to a prior bone scan from 2 months ago. The patient had no thigh pain 2 months earlier and the study was reported as new bony metastases in the femurs. There was no history of trauma or osteoporosis. Upon interviewing the patient, the history of bisphosphonate use (pamidronate for 4 years followed by zoledronic acid started 7 months ago) for hypercalcemia was obtained. The diagnosis of bisphosphonate related incomplete atypical femoral stress fractures was made based on the bone scan and subsequently confirmed by X-ray and CT. The patient subsequently had prophylactic IM nailing of the left femur and the pathology confirmed the diagnosis of atypical fracture.

Patients with bisphosphonate related incomplete femoral fractures could be asymptomatic. The bone scan finding of proximal femoral uptake could be mistaken as a bony metastasis if atypical fractures are not suspected and the history of bisphosphonate use not obtained. In this poster, the clinical, radiological and scintigraphic findings of atypical femoral fractures will be reviewed.



005

SAPHO ON SEQUENTIAL BONE SCANS

Owais Kotib, Hassan Almubarak, Alaa Bakkari and Wanzhen Zeng

Objectives: Present a case of SAPHO with sequential bone scan findings in a patient with pain in the right shoulder. Review of clinical, scintigraphic, radiographic, and pathological presentation of SAPHO.

SAPHO (Synovitis, Acne, Pustulosis, Hyperostosis and Osteitis) syndrome is a complex disorder, characterized mainly by combinations of bone lesions and dermatologic manifestations. In this poster we present a case of SAPHO with 2 bone scans performed 12 years apart.

A 50-year-old female presented with right should pain. A three-phase bone scan was performed which showed moderate uptake at the right first costochondral cartilage on the delayed image with normal flow and pool. The subsequent CT thorax suggested chronic indolent infection. The patient therefore underwent bone biopsy which was negative for infection. The patient was lost for follow-up until 12 years later when a second bone scan was performed due to incidental CT findings of bone sclerosis. Compared to the first bone scan, there were more extensive bony lesions involving the right first costochondral cartilage, manubrium, the proximal portion of the body of the sternum, and with extension to the left first costochondral cartilage. In addition, uptake in a few ribs and vertebral bodies of cervicothoracic spine at several levels was identified, correlated with sclerotic changes on CT. The patient had no known malignancy. A final diagnosis of SAPHO was made based on the findings from sequential bone scans and CT.

Diagnosing SAPHO syndrome is difficult because it is often confused with suppurative osteomyelitis, which has similar clinical and pathologic findings. In this poster we will review scintigraphic and radiologic findings of SAPHO. The clinical presentation, pathophysiology, aetiology, and treatment of SAPHO will also be reviewed.

006

FALSE POSITIVE VOCAL CORD UPTAKE ON FDG-PET DUE TO TEFLON INJECTION

Hassan Almubarak, Owais Kotbi, Fahad Al-Lhedan, and Wanzhen Zeng

Objectives: Present a case of intense right vocal cord uptake on FDG-PET secondary to a Teflon injection in a patient with history of cervical sympathectomy and right vocal cord paralysis. Review common and uncommon causes of vocal cord uptake on FDG-PET.

In patients with lung cancer or other malignancies involving the mediastinum, it is not uncommon to observe asymmetrically increased vocal cord uptake with vocal cord paralysis on the contralateral site due to recurrent laryngeal nerve injury. The findings of increased FDG activity at the side of vocal cord paralysis are rare, as in the case presented here.

The patient is a 78-year-old female with recent CT findings of a pulmonary nodule in the left upper lobe. On FDG-PET, there is a mildly hypermetabolic pulmonary nodule in the left upper lobe peripherally, which was later biopsy proven to be an adenocarcinoma. There is no lymphadenopathy in the mediastinum or hila. There is an unexpected finding of intense right vocal cord uptake with a maximum SUV of 13.3, corresponding to soft-tissue density lesion on CT. The study was reported as suspicious for laryngeal squamous cell carcinoma, as the history of prior surgery was not available at the time of reporting.



The PET findings prompted further review. The patient's history was significant for Raynaud's disease that was treated surgically by bilateral cervical sympathectomy many years ago. The patient subsequently developed right vocal cord paralysis and was managed by Teflon injection to medialize the paralyzed right vocal cord. Intense increased FDG uptake by Teflon injection is a rare and unexpected finding. The mechanism of FDG uptake by Teflon injection will be discussed. Common and uncommon causes of vocal cord FDG-uptake will be reviewed.

007

SMALL CELL CANCER OF THE PAROTID GLAND

Hassan Almubarak, Max LeBlanc, Owais Kotbi & Wanzhen Zeng

Objectives: Present a case of small cell carcinoma (SmCC) of the parotid gland and the lung. Discuss the clinical presentation and imaging findings of SmCC in the parotid gland.

Salivary gland SmCCs are extremely rare with primaries accounting for less than 1% of salivary gland tumors and metastasis from lung only being reported in select case studies. In this poster we present a case of parotid gland SmCC and lung SmCC.

A 73-year-old gentleman presented with a lump over his right parotid region which had grown over 10 months. The initial fine needle aspiration (FNA) at 4 months was negative, however a second FNA was positive with markedly atypical small cells and abundant lymphocytes, consistent with SmCC. On subsequent staging FDG PET, a soft tissue mass of 3 cm within the right parotid gland was identified with intense FDG uptake. In addition, a highly hypermetabolic mass of 7 cm was also identified in the right lung. The patient was previously a heavy smoker with a 110-pack year history and had a positive family history for cancer, with 2 first degree relatives had lung cancer and 1 had throat cancer.

The pulmonary tumor was biopsied which demonstrated similar histological features to the parotid biopsy. Based on the pathologist's opinion, the pulmonary mass may represent a metastasis from the known parotid tumor, however a new lung primary could not be excluded. Based on the intensity of the parotid gland and lung FDG activity, a primary lung SmCC as a synchronous cancer appears to be more likely.

In this poster we will review imaging findings of ultrasound, CT, FDG PET and MRI of the salivary gland SmCC. The clinical presentation, pathophysiology, etiology, epidemiology and prognosis of salivary gland SmCC will also be reviewed.

008

THE SPECTRUM OF FDG-PET/CT IMAGING OF ADRENAL MALIGNANCIES

Charles Intenzo, M.D., Daly Colarossi, Sung M. Kim, M.D.

Objectives: FDG-avid adrenal masses are not an uncommon finding on positron emission tomography in the oncologic population. This atlas presentation demonstrates the various appearances of both primary and metastatic tumors of the adrenal gland.

Methods: Over a 5-year interval, the PET/CT images of hypermetabolic primary and metastatic adrenal lesions were reviewed and correlated with histopathological results.

Results: Both primary and metastatic adrenal lesions were identified by PET/CT. The latter included both the usual and unusual, i.e. adrenal metastases from lymphoma, breast, myeloma, lung, melanoma and cervix. Several of these were either undetected or unappreciated on anatomic cross-sectional imaging such as CT and MRI. The



maximum SUV ranges from 3.42 to 33.35. In many instances, follow up PET demonstrated either improvement or progression of disease, thereby influencing the course of therapy.

Conclusion: FDG-PET/CT is a sensitive tool in adrenal malignancies, and plays a definite role in patient management, i.e. follow up and therapy.

009

RESIDUAL RADIOACTIVITY FOLLOWING MEDICAL PROCEDURES: GUIDELINES FOR MANAGEMENT OF THE DECEASED

Rachel Timmins – Canadian Nuclear Safety Commission

Medical procedures involving the use of radioisotopes are common throughout Canada and many parts of the world. Residual radioactivity from such procedures will remain in a patient's body for a period varying from a few days to more than a year depending on the type of procedure and the radioisotope used.

When a patient is released from a hospital, they pose minimal risk to the public. In the unlikely event that a patient dies within a short period following their procedure, the radioisotope may still be present in the body.

Hospitals are required to provide patients and their families a few simple precautions for reducing exposure to others for a limited period of time. After sufficient time has passed, the radioactivity will be reduced to levels that require no special precautions.

If the patient dies shortly after the procedure the situation may change and special precautions may be recommended to protect:

- death-care professionals who may come in contact with the body
- family members
- the general public

As part of its mandate to disseminate scientific and technical information, the Canadian Nuclear Safety Commission has developed a guidance document that provides basic radiation protection information on the on the safe handling of decedents. REGDOC-2.7.3, *Radiation Protection Guidelines for Safe Handling of Decedents*, provides guidance and recommended practices for minimizing radiation exposure to death-care professionals and other members of the public who may encounter a decedent with residual radioisotopes from medical procedures.

This presentation will discuss the recommendations provided in the REGDOC, developed with the overall goal of sharing information. The CNSC has received specific requests from cancer treatment centres and death-care professionals to provide guidance on this issue. The practical guidance will ensure that those involved are afforded adequate protection while also respecting the wishes of the grieving family and loved ones.

010

THE VARIABILITY IN NUCLEAR MEDICINE VENTILATION-PERFUSION IMAGING FOR CHRONIC THROMBO-EMBOLIC PULMONARY HYPERTENSION IN WESTERN CANADA

Jennifer M Smith MRT(NM), A. Suchak, MD, FRCPC, Dr. J. Weatherald, MD, FRCPC

Objectives: The objective of this study is to determine the variation of Western Canadian ventilation-perfusion (V/Q) scan technical parameters, equipment acquisition details, and physician reporting style when screening and diagnosing Chronic ThromboEmbolic Pulmonary Hypertension (CTEPH).

Methods Used: A questionnaire survey of Nuclear Medicine technologists and physicians who perform V/Q



imaging for CTEPH in Western Canada was created. The survey consisted of multiple choice questions and fill-in-the-blank answers to obtain information such as gamma camera settings, acquisition parameters, radiopharmaceutical agents used, imaging technique and reporting style.

Results: The sites polled all perform V/Q imaging for CTEPH, with some variability in the image acquisition parameters and settings identified, even with constancies of camera manufacturers. All sites polled use Technegas and MacroAggregated Albumin (MAA) as radiopharmaceuticals when possible, but there does exist some variability in the imaging techniques and diagnostic criteria/reporting styles.

Conclusions: Despite some variability in the technical parameters and reporting styles, generally consistent imaging is performed for the CTEPH V/Q imaging in the Western Canada sites polled. Continued data acquisition from additional Western Canadian sites as well as the remainder of Canada will be helpful in further evaluating potential variability in this important diagnosis.

011

COMPARISON OF FRAX AND CAROC FRACTURE RISK ASSESSMENT TOOLS

Jamie Grandy, Dr. Jeffery Flemming

Objective: What is the concordance in 10-year fracture risk categorization when using the FRAX tool compared to the CAROC tool in our patient population, and which clinical risk factors cause different risk categorization?

Methods: Retrospective analysis of 100 randomly selected patients who had a bone mineral density study completed in St. John's, NL. The 10-year fracture risk category was calculated using both the FRAX and CAROC tool for each patient. Concordance was assessed using percent agreement and a quadratic weighted kappa statistic. Clinical risk factors present in discordance cases were recorded.

Results: The concordance in calculated 10-year fracture risk categorization when using the FRAX tool compared to the CAROC tool showed a percent agreement of 80% (0.71-0.87). Quadratic weighted kappa statistic was 0.80 (0.69-0.91). Overall, FRAX classified 2 additional patients as high risk compared to CAROC in this sample of 100 patients. There were 20 cases when the risk categorization was different between FRAX and CAROC. Parental hip fracture was the most prevalent cause for discrepancy, present in 8 of the 20 discrepancies. Following this was secondary osteoporosis, present in 5 of the 20 discrepancies.

Conclusions: In this sample of 100 patients, the FRAX and CAROC tools showed a percent agreement (kappa) of 80% (0.80). This value is similar to the values previously published in the literature. FRAX categorized 2 additional patients as high risk compared to CAROC in this sample of 100 patients. In the 20 cases where risk categorization was different, the two most prevalent clinical risk factors were parental hip fracture and secondary osteoporosis, respectively. Overall, if FRAX replaces CAROC as the preferred fracture risk assessment tool in our patient population, there may be a slight increase in the number of patients classified as high risk of fracture and recommended to start pharmacologic therapy.

012

INITIAL STAGING OF COLORECTAL CANCER WITH MULTIPHASE IV CONTRAST ENHANCED FDG-PET/CT VERSUS CT ALONE

James Curtis, Anne Borowiec, Daniel Schiller, Gavin Low, Edward Wiebe, Michael Seidler, Chris Winter, Jonathan Abele



Objectives: Our aim is to compare the initial staging of colorectal cancer with FDG-PET/CT including multiphase contrast-enhanced CT versus multiphase CT alone.

Methods: 76 consecutive patients with suspected primary colorectal cancer endoscopically underwent a staging FDG-PET/CT (CT protocol included breath-hold chest, arterial-phase from skull base-mid thigh, portal venous phase through the liver). 3 dual certified Radiology/Nuclear Medicine reviewers evaluated combined PET/CT data, while 3 body radiologists reviewed CT images (blinded to PET). Mimicking clinical workflow, reviewers listed suspect lesions and their confidence as to whether these were suspicious or diagnostic of metastasis. Consensus majority opinions on the presence of suspicious distant metastases and specifically distant nodal, lung, or liver metastases were generated and compared against available imaging and clinical/pathological results, with a mean imaging follow-up of 2.0 years (Range:0-5.2yrs, 11 patients had no post-operative imaging).

Results: 12/76 patients had confirmed distant metastases on follow-up, with locations of involvement listed in the attached table. CT-only consensus estimates and PET-CT consensus estimates were compared to the clinical standard, yielding sensitivities and specificities for metastases by location in each group listed in the attached table. Estimates of performance indicated higher accuracy and specificity of PET-CT interpretations compared to CT-alone for distant nodal and liver involvement, at the expense of a reduced sensitivity, while lung involvement had comparable specificity but slightly improved sensitivity on PET-CT interpretation.

Conclusion: Combined PET-CT interpretation led to more conservative estimates of disease, which may be justified given absent metabolic activity in many equivocal findings, however this may also contribute to inappropriate dismissal of early metastasis. CT-only assessments were also problematic, as high false positive rates may lead to over staging or delay definitive management pending workup of equivocal findings. FDG PET-CT provided a more accurate initial staging of metastatic disease.

Metastatic involvement based on clinical/pathological follow-up	Reviewers	Definite metastatic involvement (consensus)	Suspicion of metastatic involvement (consensus)	Suspicion of metastases		
				Sensitivity	Specificity	Accuracy
Distant nodal involvement	4 CT-only	3	13	75	90	89
	PET-CT	0	3	50	97	95
Liver involvement	5 CT-only	5	29	100	66	68
	PET-CT	3	6	80	97	96
Lung involvement	7 CT-only	1	10	57	91	88
	PET-CT	0	10	71	92	91
Any distant metastatic involvement	12 CT-only	11	37	92	59	64
	PET-CT	8	12	58	92	87

014

CNSC REGULATORY OVERSIGHT REPORT REVIEW FOR 2016

Peter Fundarek

The Canadian Nuclear Safety Commission (CNSC) regulates the use of nuclear substances and prescribed equipment across Canada. Of the over 2000 licences issued by the CNSC, licensed activities involving application in medicine, academia and research comprise over 36% of these licences. Each year, the CNSC publishes a Regulatory Oversight Report on the Use of Nuclear Substances in Canada, which summarizes the safety assessment of CNSC licensees in Canada. The most recent publication is the report for the year 2016. This report was presented to the Commission Tribunal in a public meeting on October 12, 2017 and will be eventually published, being made available through the CNSC website. The presentation will provide an overview of how the annual report is prepared, including information on opportunities for public comment on the draft version of the report prior to the Commission meeting. The presentation will offer an overview of the safety assessment in two sectors of the report; the Medical Sector and the Academic & Research Sector. For each sector, information will be provided regarding the performance of CNSC licensees with respect to: doses to workers; management system; operating performance; radiation protection; and, security. The performance of each sector in



comparison to the aggregate of the CNSC licensees will also be provided to demonstrate how that sector is performing in the overall context. Finally, information will be presented regarding matters in which the Commission has expressed an interest and, where applicable, to address any direction given by the Commission. Information will also be presented by staff on innovative approaches to the licensing process, that the CNSC is considering for implementation to reduce the administrative burden on applicants and to streamline the licence application process without compromise to safety.

015

ENHANCING REGULATORY OVERSIGHT OF RADIATION SAFETY OFFICERS OF NUCLEAR SUBSTANCES AND RADIATION DEVICES LICENCES

Paul Matthews

The role of Radiation Safety Officer (RSO) is critical to ensuring that activities under Nuclear Substances and Radiation Devices licences issued by the Canadian Nuclear Safety Commission (CNSC) are conducted safely. The CNSC's key expectations for the qualifications for the RSO are laid out in CNSC REGDOC-1.6.1, Licence Application Guide: Nuclear Substances and Radiation Devices. Overall, the qualifications of an RSO must be in proportion to the risk of the regulated activities to be undertaken, which the CNSC evaluates during licensing process and monitors through compliance verification activities. With a range of use-types and risk categories of licensed activities, the CNSC sees a variety of qualifications associated with the person undertaking the role of RSO. Regardless of the activity, the RSO is typically responsible for the administration and control of radiation safety programs. As such, the performance of the radiation safety program is closely related to the performance of the RSO in this function. The CNSC is exploring the factors that lead to the success of RSOs in fulfilling their radiation safety function in the interest of identifying whether these factors can be leveraged as part of the CNSC regulatory oversight approach. This presentation outlines a review of the current situation and a planned study to be undertaken by the CNSC of the necessary elements to succeed as RSO.

016

INVESTIGATING THE CLINICAL RELEVANCE OF XSPECT BONE

Jessica L. Dobson, Dr. Jeffery Flemming

Objectives: We aim to evaluate whether the improved resolution attained with Siemens' xSPECT Bone reconstruction method provides additional clinically relevant information compared to conventional SPECT/CT.

Methods: A retrospective chart review of the Picture Archiving and Communication System (PACS) was completed, including all patients who have had xSPECT Bone imaging at the Department of Nuclear Medicine of the Health Sciences Centre, St. John's, NL. This list consists mainly of patients undergoing SPECT/CT scans of the spine and foot, as regions of detailed anatomy, over a five-month period. Grouping results based on the location of the scan and its indication, Hermes Viewer was used to assess the scan quality and the clinical relevance of xSPECT Bone.

Results: In total, 65 charts were identified and their xSPECT Bone and SPECT/CT images analysed. Of these, xSPECT Bone data could be processed in 63. The predominant indication being to assess for metastases, 44 were of the spine or ribs; 16 were of the foot, mainly to evaluate the cause of pain. Two scans of hand and one knee were also examined. This work-in-progress has revealed some degree of improved confidence in lesion localization, and artifacts unique to xSPECT Bone images, thought to result from smoothing and attenuation correction.



Conclusions: With this poster, we will present a pictorial summary of our findings, illustrating the potential pitfalls and artifacts we have identified in addition to examples of clinical scenarios in which xSPECT Bone appears particularly useful or challenging.

017

SAFETY CULTURE MATURITY IN THE MEDICAL SECTOR

Mark Broeders

A healthy safety culture is a key factor in reducing the likelihood of safety-related events and mitigating their potential impact, and in continually improving safety performance. All workers have a shared responsibility to ensure that a healthy safety culture is a priority. In an era of heightened public scrutiny regarding access and wait times for priority procedures, including radiotherapy and diagnostic imaging, medical institutions must remain vigilant to ensure that staff safety is not compromised while still delivering timely patient care. The balance between safety and workload is one of fourteen safety culture maturity indicators included in CNSC's draft REGDOC 2.1.2: Safety Culture. This presentation will highlight the indicators of a mature safety culture and participants will be challenged to nurture their questioning attitude when they return to their institutions. Using the safety culture maturity framework outlined in REGDOC 2.1.2, participants will learn about the three stages of safety culture maturity: 1) Requirement Driven: Safety is primarily reactive and driven by formal rules and management direction, 2) Goal Driven: Good safety performance becomes an organizational objective and is dealt with primarily in terms of safety goals; and 3) Continually Improving: Safety is seen as a continually improving and proactive process, beginning with all workers sharing a clear vision of and value for safety. The relationship between the management system and safety culture will be discussed as well as the link between safety and security culture.

018

THE CANADIAN MEDICAL IMAGING INVENTORY (CMII): BENEFITS FOR DECISION-MAKERS

Andra Morrison, Alison Sinclair, Calvin Young

Objective: To collect and analyze data on CT, MRI, PET-CT and PET, SPECT, SPECT-CT, and PET-MRI machines across Canada to help guide strategic direction, inform lifecycle planning, and identify gaps in service.

Methods: Data were primarily collected via a national web-based survey sent to health care facilities across Canada. Site-level data consisted of unit availability and counts, average hours of use, total number of annual exams, and breakdowns of types of use. Unit-level information consisted of manufacturer, model and year of installation, and modality-specific technical characteristics such as the number of detectors/slices for CT and the field strength for MRI.

Results: Data were collected from 505 health care facilities on 1,615 imaging units across Canada. Usage data may help decision-makers understand the future demand for medical imaging equipment by increasing understanding of aspects of capacity:

- Location of hospitals providing 24 hour and weekend imaging services
- Range of potential life expectancies of equipment based on use
- Whether existing equipment can be used more optimally
- Options for managing wait time targets, by redirecting patients to underused sites.

Data on the age, location, and technical characteristics of equipment may help inform Canadian projections for future imaging needs such as:

- When equipment might need to be replaced, upgraded, or refurbished in accordance with



Canadian Association of Radiologists (CAR) guidance • Where equipment might be needed • Mobile equipment and its deployment • Equipment that tracks radiation dosage.

Conclusion: An accurate inventory of imaging equipment promotes the optimization of equipment and human resources, helps decision-makers anticipate future demand, and facilitates appropriate use. The CMII also provides Canadian data for OECD comparisons for CT and MRI.

019

THE CHANGING LANDSCAPE OF NUCLEAR MEDICINE IMAGING MODALITIES: WHAT HAVE THE LAST 10 YEARS BROUGHT?

Andra Morrison, Alison Sinclair, Calvin Young

Objectives: To analyze nation-wide data to identify and understand trends in PET-CT, PET-MRI, SPECT, and SPECT-CT equipment installation and use.

Methods: Used A web-based survey was sent to health care facilities across Canada in 2017 to collect data on specialist imaging equipment, including those used in nuclear medicine. The data collected included information on number of machines, location, types of use, and technical specifications. The data on number of machines and locations was compared with data from 2006–2007. Results Obtained Data was obtained from 505 health care facilities across Canada, most of which are publicly funded hospitals, community hospitals, or tertiary care centres in urban areas.

Results: show a total of 51 PET or PET-CT units, 3 PET-MRI units, 325 SPECT units, and 266 SPECT-CT units. The first PET-MRI machine was installed in 2012 in London, Ontario. Each imaging modality, with the exception of SPECT, experienced growth over the last 10 years in Canada. The most rapid growth occurred with the hybrid modality SPECT-CT, with the overall number of SPECT-CT machines increasing from 35 in 2006–2007, to 264 in 2016–2017. This represents an increase of 654% over the last decade. Likewise, the number of provinces with SPECT-CT machines doubled from five jurisdictions in 2006–2007 to ten jurisdictions in 2016–2017. PET-CT also experienced significant growth, with 20 new units installed in the last 10 years and nine provinces now hosting machines.

Conclusion: There is a growing trend in the prevalence of imaging modalities in nuclear medicine in Canada, but a decline in SPECT. The decline in SPECT may be connected to the rapid adoption of SPECT-CT, which offers better imaging results for certain types of exams. Hybrid modalities are becoming more common in general, with greater distribution of equipment within and across provinces, especially for SPECT-CT and PET-CT.

020

RADIATION PROTECTION AND SAFETY IN CANADA: AWARENESS OF THE BONN CAL FOR ACTION

Andra Morrison, Program Development Officer, CADTH; Dr. Sandor Demeter, Nuclear Medicine, Health Sciences Centre, Winnipeg; Dr. David Koff, Chair Department Radiology, McMaster University, Ontario.

Background: The increased use of radiation for diagnostic purposes has raised potential health concerns for patients and medical staff. In 2017, Canada Safe Imaging in collaboration with CADTH conducted a pan-Canadian survey to determine awareness and implementation of the Bonn Call for Action recommendations amongst the radiation safety community. The Bonn Call for Action is defined by ten priorities for promoting radiation



protection, including optimizing equipment, quality assurance and protocols, and justification to ensure the best test is chosen for the patient's specific clinical scenario.

Method: The survey asked Canadian health professionals working in radiation safety to report on the extent to which the 10 Bonn Call for Action priorities have been implemented in their jurisdictions. As well, for each priority, survey responders were invited to provide feedback on: initiatives that promote compliance; policy and practice issues that impact the application of the principles; actions to help harmonize radiation protection activities across Canada; and ideas to support the principles in the future.

Results: This presentation summarizes the results of the survey as reported by 44 participants from all provinces. More than half of the survey responders were not aware of the Bonn Call for Action. Some common themes emerged, such as the role of industry and government in supporting radiation protection practices, the importance of education and training, stakeholder engagement, and collaboration amongst the medical imaging community.

Conclusion: While there are numerous initiatives in Canada aimed at radiation protection and safety, not all are implemented and adherence can vary from province to province, facility to facility, and in some instances from department to department.

021

DIAGNOSIS OF PULMONARY EMBOLISM IN THE CANADIAN CONTEXT: CLINICAL REVIEW FINDINGS FROM A HEALTH TECHNOLOGY ASSESSMENT

Alison Sinclair, Kwakye Pephrah, Teo Quay

Objective: To determine the best strategy for the diagnosis of pulmonary embolism (PE) in the Canadian context. PE is a diagnostic challenge, since it shares symptoms with other conditions. Diagnosis involves a multi-step pathway consisting of clinical prediction rules (CPRs), laboratory testing, and diagnostic imaging, but the best strategy in the Canadian context is unclear.

Methods: We carried out a systematic review of the diagnostic accuracy, clinical utility, and safety of diagnostic pathways, CPRs, and diagnostic imaging for the diagnosis of PE. Clinical prediction rules were studied by an overview of systematic reviews, and pathways and diagnostic imaging by a primary systematic review. Where feasible, a diagnostic test meta-analysis was conducted, with statistical adjustment for the use of variable and imperfect reference standards across studies.

Results: The Wells CPR rule showed greater specificity than the Geneva, but the relative sensitivities were undetermined. Application of a CPR followed by with D-dimer laboratory testing can safely rule out PE. In diagnostic test accuracy meta-analysis, CT (sensitivity 0.973, 95% CrI 0.921 to 1.00) and VQ-SPECT (sensitivity 0.974, 95% CrI 0.898 to 1.00) had the highest sensitivity) and CT the highest specificity (0.987, 95% CrI 0.958 to 1.00). VQ and VQ-SPECT had a higher proportion of indeterminate studies, while VQ and VQ-SPECT involved lower radiation exposure than CT. Recommendations, developed by an expert committee and based on the evidence and findings from this health technology report, are currently being developed. Recommendations will detail optimal pathways, including diagnostic imaging, for the diagnosis of PE.

Conclusion: Our review found that CT is the most accurate single modality, but CPR and D-dimer testing can be used to avoid unnecessary imaging. Others factors (e.g., contraindications) must also be considered. These findings, in conjunction with a recent CADTH health technology assessment, may help to inform clinical practice and guidelines.

022



CORONARY ARTERY DISEASE: FROM SPECT MYOCARDIAL PERFUSION IMAGING TO CORONARY ANGIOGRAM WITH INTERVENTION; FROM SYMPTOMS TO PREVENTION!

Dr. Asad Jalil, Dr. Sajid Sattar, Dr. Muhammad Jawaid Ansari, Dr. Hira Bibi, Mr. Imtiaz-ul-Haque Khurshaidi, Mrs. Aetidal Rameez, Miss Qurratulain

Background: Coronary artery disease is the one largest cause of death worldwide, with male and post-menopausal women predominance. Hypertension both systolic and diastolic has been found to have a linked with increase incidence of coronary artery disease (if remain untreated for long time). SPECT Myocardial perfusion imaging is a better non-invasive technique because of its higher predictive accuracy than that of exercise tolerance test and providing risk stratification along with diagnosis of fixed verses reversible perfusion defect in myocardium. While coronary angiogram is an invasive but definitive diagnostic technique for coronary artery disease because it reflects the detailed anatomy of coronary artery with nature, site and extent of disease present in it. If needed, percutaneous transluminal coronary angioplasty can be performed during left heart catheterization procedure. We are presenting a case of a patient who received coronary artery intervention after going through myocardial perfusion imaging.

Case History: A 63-year-old married female who's a known case of uncontrolled hypertension for more than 5 years, gout, osteoarthritis and acid peptic disease with history of treated right sided supraclavicular lymph node tuberculosis 16 year ago. 5 months back she went to E/R of a private hospital with complain of epigastric and bilateral shoulder discomfort (not pain), sudden onset of weakness and exertional dyspnoea. At that time, on the basis of history-examination and investigations she was diagnosed as a case of hypertensive crises. Later, on her visit to cardiologist OPD, she was advised stress myocardial perfusion imaging for the assessment of coronary artery disease. Her hematological investigations were within normal limits (including multiple sets of Trop-I enzyme and BNP levels). ECG showed poor progression of R-wave in precordial leads with atypical ST changes. Echocardiography showed an enlarged LA(42), mild Aortic Regurgitation, Grade-1 diastolic dysfunction with normal wall motion analysis and ejection fraction of 65%. Two day protocol myocardial perfusion imaging was performed with the dose of 7mCi Tc-99m Tetrofosmin each day. Resting study was performed on day one. On second day patient with complete preparation (4 hour fasting, holding all rate limiting medicines and foods, etc) was exercised for 2:19 minute reaching 1st stage of Bruce protocol. Her pulse rose from 82 to 141 bpm and blood pressure from 160/80 to 170/100 mmHg. Exercise was stopped due to dyspnoea, fatigue and chest pain which was relieved during recovery period. Sinus tachycardia, PVCs with ectopic beats were noted during and after peak exercise, which reverted back to baseline in the end of recovery period. Near maximal exercise, negative test with good effort tolerance observed. Adequate hemodynamic response to exercise is noted. SPECT images were acquired around an arc of 180o (RPO-LPO) using low energy high resolution collimator gamma camera. Her myocardial SPECT at 90% of age predicted heart rate and workload of 3 METS revealed small size partially reversible ischemia of mild intensity involving apical segments of antero-septal and apical anterior wall. On the basis of myocardial perfusion imaging, her cardiologist advised her coronary angiography. Her coronary angiography showed 90% stenosis in mid LAD, 70% stenosis in proximal OM, 60% stenosis in distal RCA, leaving left main coronary artery normal. After discussing with the patient and her attendants, PCI to LAD with aggrastat infusion was done during the coronary angiography procedure. Post intervention with good compliance on medication and adopting healthy life style (appropriate diet and regular exercise) patient feel better and on multiple routine follow-up remained symptom-free. Point to remember is; A non-invasive procedure of SPECT Myocardial Perfusion Imaging can be helpful in patients who presents with atypical symptoms but have any of the risk factor for coronary artery disease. However, coronary angiography remains the best option in patients with CAD because percutaneous intervention can be done during the single invasive procedure where needed, thus preventing future risk of cardiac event.



F-18 FDG LABELING OF HUMAN WHITE BLOOD CELLS

Dr. Ashley Mummery, Jan Cockshutt, and Dr. Jonathan Abele

Objectives: Primary: perform a pilot study to assess the feasibility of labeling white blood cells (WBC) with 18F-Fluorodeoxyglucose (FDG). Secondary: (1) assess the viability of the WBC after labeling; and (2) determine number of washes required to minimize free FDG in the WBC suspension.

Methods: WBC from 10 healthy human volunteers were labeled with 370 MBq FDG using a procedure derived from our institution's current 99mTc-HMPAO WBC labeling technique. Successful labeling was defined as WBC FDG activity ≥ 108 MBq after the first wash. Viability of the WBC was assessed by trypan blue dye exclusion. FDG activity in the samples was assessed in the WBC pellet following each wash. We used 2 washes in the first 5 samples and 3 washes in the last 5 samples.

Results: WBC were successfully labeled in 2 of 10 samples. The viability of the WBC following this labeling procedure was greater than 99% in all samples. The activity of the WBC was tested following up to 3 washes. The percentage decrease in activity following each wash corrected for decay was: WASH 1 mean=66.7% SD=14.1%; WASH 2 mean=9.1% SD=3.5%; WASH 3 mean= 1.9% SD=0.7%.

Conclusions: This pilot project provides an important foundation for future clinical research. Our technique has greater than 99% viability of WBC. One wash is likely sufficient to remove the majority of free FDG to optimize WBC specific FDG activity. FDG was detected in the WBC pellet for all patients, however, only 2 of 10 WBC samples had sufficient FDG activity to be considered successfully labeled using 370 MBq. Labeling could potentially be improved by using a higher initial dose of FDG (740 MBq has been used by other groups).

024

INTERDERMINATE RATE OF SPECT V/Q IN PREGNANT PATIENTS FOR DETECTION OF PULMONARY EMBOLUS

Chan D, Ahpin C

Detection of pulmonary embolus in pregnant patients is challenging, in part due to separate radiation risks to the mother and fetus. Detection methods include ventilation perfusion scan (V/Q scan) and CT scan of the chest in the pulmonary arterial phase (CTPE). V/Q scans can be performed using different protocols, including planar, SPECT V/Q or perfusion only scans. No method has been proven to be strictly better than the other. At our centre, the standard of care is to perform a SPECT V/Q scan, with CTPE ordered at the clinician's discretion. The rationale behind this is to reduce radiation to the breast while providing more specific detection of pulmonary embolus than perfusion only scanning. Therefore, this study aims to determine the clinical utility of V/Q scans, by determining both the indeterminate rate (which would necessitate additional workup), as well as the rate of perfusion defects (a situation which limits the value of a perfusion only scan). All V/Q scans performed on pregnant patients at our centre from January 2014 until June 2017 were collated. The indeterminate rate was calculated (1.3% - 1/80). The percent of studies that had perfusion defects was also calculated (25% - 20/80). Additionally, CTPE scans performed on pregnant patients during the same time period were reviewed. In general, a CTPE scan was performed due to two main reasons: hemodynamic instability or clinical features suggesting an alternate etiology. Of note, CTPE scans also had limitations, where the reporting radiologist felt that the study quality limited assessment. This rate was 56% (9/20). Overall, this study found that V/Q scans have very low indeterminate rate, with only two patients who had V/Q scans going on to have CT chests (for pulmonary embolus, and empyema assessment). As well, a significant number of patients had perfusion defects, which may limit the utility of perfusion only scans.

025



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APPLYING 2-18F-FLUOROETHANOL PET TO INVESTIGATE INTERVENTIONS TO MODIFY SOLID TUMOUR PERFUSION

Brennan J Wadsworth, Kuo-Shyan Lin, Francois Benard, Kevin L Bennewith

Objectives: We aimed to investigate the ability of 2-18F-Fluoroethanol, a reporter of solid tumour perfusion, to predict tumour hypoxia and to quantify the effect of pharmacological strategies that modify tumour perfusion.

Methods: Mice bearing orthotopic murine mammary carcinomas and immune compromised mice bearing subcutaneous human tumour xenografts were assessed for 2-18F-Fluoroethanol uptake by gamma counter or positron emission tomography (PET). Tumour hypoxia was quantified by immunofluorescent microscopy and flow cytometry detection of 2-nitroimidazole compounds. Drugs tested included the vasoactive drug nicotinamide and hemorheologic drug pentoxifylline, which are referenced to acutely reduce tumour hypoxia, and losartan, which is referenced to relieve compression of tumour vessels when administered chronically.

Results: Our data demonstrate that baseline-untreated 2-18F-Fluoroethanol uptake provides sufficient dynamic range to distinguish poorly-perfused tumours from well-perfused tumours. Further, we observe a moderate negative correlation between 2-18F-Fluoroethanol uptake and hypoxia in human tumour xenografts, detected by flow cytometry ($r = -0.6081$, $N=20$). While we hypothesized that pharmacological interventions that reduce hypoxia would increase net perfusion to tumours, we instead observed that all three drugs tested either had no effect on total 2-18F-Fluoroethanol tumour uptake or reduced radiotracer delivery. Our data indicate that pentoxifylline and nicotinamide may act by inducing the 'steal effect' whereby local healthy tissue exhibits increased perfusion in response to these drugs and draw blood away from the tumour. Nevertheless, we did observe reduced hypoxia in response to perfusion-modifying drugs and found that this could be explained by drug-induced redistribution of tumour perfusion. Specifically, we observed regional-specific changes in immunofluorescent microscopy of vessel function and hypoxia, and increases in radiomic descriptors of homogeneity for 2-18F-Fluoroethanol uptake.

Conclusions: In conclusion, 2-18F-Fluoroethanol PET can be applied as a reporter of solid tumour perfusion that can predict tumour hypoxia and quantify the effect of perfusion modifying drugs in healthy tissue and solid tumours.

Eric Lepp Clinical Vignettes

EL-001

PROSTATE CANCER IN THE ERA OF MOLECULAR IMAGING: PITFALL

Guillaume Chaussé

A 71-year-old man with prior recurrent prostatitis presented because of elevated prostate specific antigen (PSA) serum levels. The long-term trend for PSA level was that of slowly increasing PSA with time and few spikes consistent with episodes of prostatitis. More exactly, PSA doubling time (PSAdt) was approximately 3-4 years for the past 7 years reaching an absolute PSA level of 14 mcg/L; a recent surge to 20 mcg/L was noted by the clinician. Underlying prostatitis was suspected.

As the level had arisen to a suspicious extent, further confirmatory imaging was ordered. MRI of the prostate was adamant about the presence of a 4.6 cm transition zone nodule and a 1.7cm peripheral zone nodule, both PI-RADS score 5, consistent with prostatic malignancy. On FDG PET/CT, intense uptake (maximum standardized uptake value (SUVmax) 11) localized to the prostate bed was consistent with high grade prostate cancer and



atypical for prostatitis given the focality of the lesion. No extra-prostatic involvement was demonstrated. Bone scan was negative for bone metastases. On 18F-DCFPyl, only ill-defined faint uptake is seen at the periphery of the largest lesion.

Ultrasound-guided transrectal biopsy revealed prostate cancer with Gleason Scores up to 9. Morphology was that of normal acinar adenocarcinoma. Further staining demonstrated mild PSMA foci in epithelial cells, and negative synaptophysin and chromogranin stains.

This case illustrates an important pitfall in prostatic malignancy molecular imaging that is the presence of malignant histological variants that do not significantly express PSMA receptors. Among these are most noticeably the neuro-endocrine differentiation; it now seems that some acinar adenocarcinoma might be part of that group. Although PSMA imaging is unmatched for biochemical recurrence, its lower sensitivity in initial staging remains to be elucidated. This may impact our use of staging modalities and treatment possibilities.

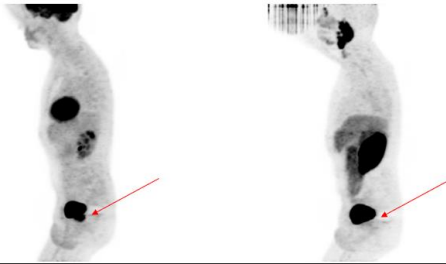


Figure 1. Lateral views of Maximum Intensity Projections (MIP) of 18F-FDG (left) and 18F-DCFPyl (right). FDG uptake posterior to the bladder does not find a correlate on PSMA scan.

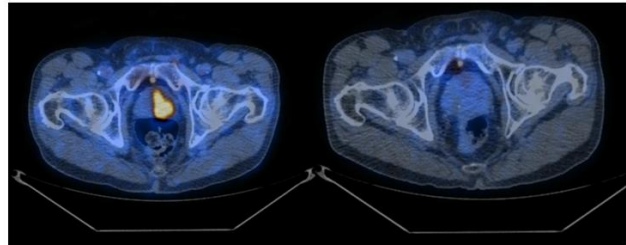


Figure 2. Axial fusion images at the level of the prostate of 18F-FDG (left) and 18F-DCFPyl (right) again demonstrating absence of PSMA ligand uptake where FDG is focal and intense.

EL-002

COMPLETE RESOLUTION OF MYOCARDIAL INFLAMMATION RELATED TO BIOPSY-PROVEN CARDIAC-LIMITED SARCOIDOSIS ON SERIAL 18F-FDG PET SCANS

Caroline Malo Pion, Geneviève Giraldeau, François Harel, Matthieu Pelletier-Galarneau

We present the case of a 54-year-old male with cardiogenic shock (LVEF 10%) and electrical storm secondary to cardiomyopathy of unknown etiology who underwent serial 18F-FDG PET/CT. Endomyocardial biopsy performed prior to imaging showed noncaseating granulomas.

A first whole-body 18F-FDG PET/CT with myocardial suppression protocol was performed 8 days after biopsy, while the patient was receiving extracorporeal membrane oxygenation (ECMO) support. It revealed intense heterogeneous myocardial uptake (SUVmax 11.0) involving most of the left ventricle but sparing the basal anterior, anteroseptal, and septal walls. The spared regions demonstrated a severe perfusion defect on rest Rubidium-82 imaging. Those findings were reported to be compatible with an active isolated cardiac sarcoidosis involving almost all the left ventricle with fibrous scarring of the hypoperfused/hypometabolic segments.

Initially, an empirical loading dose of solumedrol was given to treat possible inflammatory infiltrative disease. Afterward, based on biopsy result and proof of active extensive inflammation on the PET/CT with considerable recuperation potential, the clinical decision was made to pursue more aggressive treatment which included high corticosteroid doses and Cellcept as well as installation of a left ventricular assist device (Heart Mate II) for prolonged invasive cardiac support. A second histopathological evaluation was done on the retrieved apical portion of the left ventricle, which revealed small foci of histiocytic and lymphocytic infiltration, without active myocardial damage or granuloma, suggesting a decapitated inflammatory process.

A follow-up 18F-FDG PET/CT study with myocardial suppression protocol was performed 2 weeks later, showing complete absence of myocardial inflammation. The noteworthy clinical improvement concurs with



the second pathological evaluation and the PET study in favor of a therapeutic success. This clinical case highlights the fact that 18F-FDG PET/CT allows identification of active inflammation in sarcoidosis, which in this case led to significant alteration in the patient's treatment.

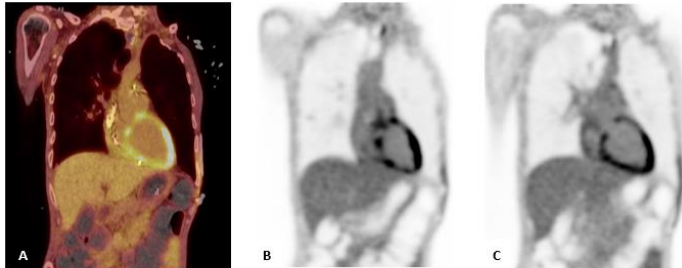


Figure 1. Selected coronal images from fused (A) and unfused (B, C) 18F-FDG PET/CT study showing intense heterogeneous myocardial uptake of all the left ventricle walls including the septum but sparing the basal portions of the anterior, antero-septal and septal walls

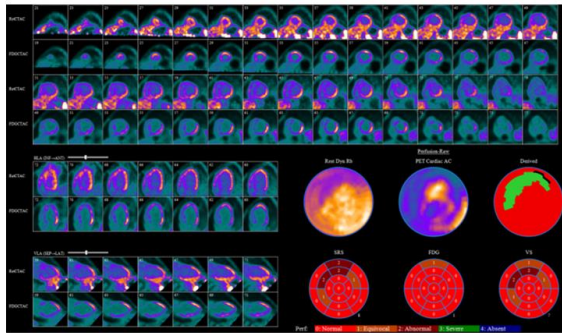


Figure 2. Rest Rubidium-82 perfusion imaging (first row) shows a severe perfusion defect of the basal portions of the anterior, antero-septal and septal walls. On 18F-FDG PET/CT imaging (second row), there is intense heterogeneous myocardial uptake following a similar distribution.

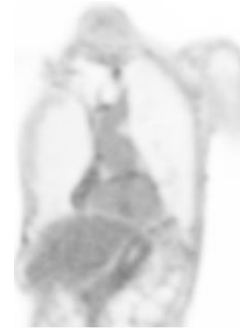


Figure 3. Selected coronal 18F-FDG PET image from a follow up 18F-FDG PET/CT study performed 22 days after initial 18F-FDG PET/CT demonstrating complete resolution of the myocardial inflammation.