

**CANM
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**BOOK OF
ABSTRACTS**

**April 10-13, 2014/ du 10 au 13 avril 2014
Calgary, Alberta**

**Canadian Association of Nuclear Medicine
l'Association canadienne de médecine nucléaire**

001

NORMAL RANGE FOR THYROID RADIOACTIVE I-131 UPTAKE (RAIU) IN CLINICAL PRACTICE; DOES IT EXIST AND DOES IT MATTER?

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Objectives: It is recognized that the main diagnostic utility of RAIU measurements is to differentiate low uptake thyrotoxicosis from hyperthyroidism due to autonomous thyroid hyperfunction (ie: Graves' disease and autonomously hyperfunctioning nodule(s)). RAIU measurement is also commonly performed for I-131 treatment planning. Our original intent was to review thyroid RAIU studies in our practice in order to determine if a reliable upper "normal" limit could be defined to differentiate between patients with diffuse toxic goiter (ie: Graves Disease) and euthyroid patients (result 1).

Methods: A retrospective chart review was conducted using RAIU studies (2010-2013) obtained from the Nuclear Medicine Departments at the General Hospital and St. Clare's Hospital in St. John's, Newfoundland. We excluded cases with a final diagnosis of low uptake thyrotoxicosis (eg: subacute thyroiditis) and cases involving nodularity because it is known that toxic hyperfunctioning nodule(s) can have RAIU measurements in the "high normal range". As in many practices, a cohort of the patients undergoing RAIU measurement were euthyroid. While this choice of control group did not represent a truly normal euthyroid population, it did represent the euthyroid patient population that would potentially be encountered in clinical practice.

Serum TSH levels were used to classify a patient as euthyroid or hyperthyroid. Given the sensitivity of modern TSH assays, many earlier (subclinical) presentations of Graves Disease were identified. Free T4 levels were therefore used to distinguish clinical from subclinical hyperthyroidism. We went beyond the original scope of our study, in order to compare the RAIU distributions of subclinical and clinical hyperthyroid patients within the broader hyperthyroid classification (result 2).

Results:

1. There was considerable overlap between the hyperthyroid and euthyroid populations, thus an upper "normal" limit could not be identified.
2. The hyperthyroid group showed a bimodal distribution, with the subclinical group having a consistently lower raiu measurement compared to the clinical group. The raiu distribution of subclinical patients did not differ significantly from the euthyroid population. Both showed considerable overlap with the clinical group, despite statistically significant differences.

Conclusions: Our results reinforce that the clinical utility of RAIU measurements is practically limited to: (i) the differential diagnosis of low uptake thyrotoxicosis, and (ii) the determination of the "optimal" dose of I-131 for radioactive iodine treatment.

002

OFF-LABEL RHTSH USE FOR PREPARATION OF RADIOACTIVE IODINE TREATMENT IN NODAL METASTATIC THYROID CANCER IS SAFE & EFFECTIVE

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Objective: To determine the safety & efficacy of the recombinant human thyroid stimulating hormone (rhTSH)

preparation method for radioactive iodine (RAI) treatment of differentiated thyroid cancer with nodal metastatic disease.

Health Canada and the FDA have approved rhTSH usage for preparation of RAI treatment in low risk thyroid cancer patients post-thyroidectomy. All alternative rhTSH usage in thyroid cancer management is considered "off-label use"; there is currently insufficient published clinical data on the safety & efficacy of off-label rhTSH use including usage in thyroid cancer patients with nodal metastatic disease.

Methods: A retrospective analysis was performed on 108 consecutive differentiated thyroid cancer patients with known neck node metastases at the time of initial surgery, treated with RAI by our institution between January 1, 2000 & December 31, 2007.

Within this selected group, 31 and 42 patients were prepared for initial and all subsequent RAI treatments exclusively by thyroid hormone withdrawal ("withdrawal") or rhTSH protocols respectively, with a requirement of at least three years local follow-up or death related to thyroid cancer. Short and long term clinical outcome & treatment responses were compared.

Results: There were no significant differences between the baseline patient characteristics of the two groups with the exception of two negative prognostic risk factors - male gender & age ≥ 45 years - which were both more prevalent in the rhTSH group ($P = 0.05$ for both parameters). The mean follow-up was significantly longer for the withdrawal group than for the rhTSH group (8.6 versus 6.8 years; $P = 0.01$).

The response to initial treatment - classified as excellent, acceptable or incomplete - was significantly better for the rhTSH group (57%, 21% and 21%, respectively) than for the withdrawal group (39%, 13% and 48%; $P = 0.05$). The rhTSH group also received significantly fewer additional doses of RAI than the withdrawal group ($P = 0.03$). There was no significant difference in the final clinical outcome assessment of the rhTSH and withdrawal groups.

Conclusion: The findings suggest that in patients who present with nodal metastatic differentiated thyroid cancer, preparation for RAI with off-label rhTSH use is a safe & efficacious alternative to the traditional thyroid hormone withdrawal protocol.

003

PATIENTS WITH SOMNAMBULISM SHOW SPECIFIC ALTERATIONS IN BRAIN PERFUSION PATTERNS FOLLOWING SLEEP DEPRIVATION

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Somnambulism is a frequent condition that leads to recurrent sleep disruption and potential injuries, but little is known about its pathophysiology. It is considered as a state dissociation phenomenon arising primarily during slow-wave sleep. However, increasing evidence indicates that somnambulism is also associated with functional abnormalities during daytime and that sleep deprivation constitutes an important driver for its induction. Here, we

studied neural mechanisms associated with somnambulism by investigating functional brain imaging using SPECT with ^{99m}Tc -ECD, in a group of adult sleepwalkers compared to controls, during wakefulness and after sleep deprivation.

Ten adult sleepwalkers and twelve controls were scanned in morning wakefulness after a full night of sleep. Using the same technique, eight of the sleepwalkers and nine of the controls were also scanned during wakefulness in the morning following a night of total sleep deprivation.

SPECT data analysis comparing rCBF between the two groups was used to identify specific brain activity patterns underlying daytime functional abnormalities associated with somnambulism.

During wakefulness, rCBF was decreased in the inferior temporal gyrus and hippocampus in sleepwalkers as compared to controls. However, hypoperfusion of the inferior temporal gyrus was actually observed in sleepwalkers only after total sleep deprivation, but not after a full night of sleep. No region displayed increased perfusion in sleepwalkers compared to controls under either condition.

These findings demonstrate that functional neural abnormalities can be observed during wakefulness in patients suffering from somnambulism. Interestingly, decreased perfusions were located in visual association areas, possibly in relation to sleepwalkers' proclivity for dreamlike visual perceptions that generally accompany their sleepwalking episodes. The fact that only under sleep-deprived condition was altered perfusion found in secondary visual areas indicates that sleep deprivation not only facilitates the occurrence of sleepwalking episodes, but also uncovers patterns of neural dysfunction that characterize these patients during wakefulness.

004

DYNAMIC HEPATOBILIARY IMAGING IN QUESTIONED CHRONIC CHOLECYSTITIS

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Objectives: To investigate the time activity curves (TACs) and, the time of maximum activity (Tmax) in the gallbladder of patients undergoing cholescintigraphy for suspected chronic acalculous cholecystitis. We suspect fibrosis related to chronic acalculous cholecystitis will delay maximal filling of the gallbladder. Additionally, we examined if the time of maximum activity in the liver and time of first discernible small bowel activity were affected in the patients with chronic cholecystitis.

Methods Used: We reviewed 88 cholescintigraphy studies at our institution between March- December 2013. 77 met inclusion criteria. 3 identical circular regions of interest were drawn over the gallbladder, right hepatic lobe and site of first small bowel activity. TACs were generated for each region with associated Tmax identified. These patients were subsequently assigned to the normal gallbladder ejection fraction (Group A) or abnormal gallbladder ejection fraction (group B) groups based on the patients ejection fraction during a 30 minute infusion protocol of intravenous synthetic cholecystokinin (sCCK).

Results: There were 62 group A and 15 group B patients. The average gallbladder Tmax was significantly different between groups (A-2671 seconds vs. B-3139 seconds; Student's *t*-test = 2.24, *p* value of 0.028). Liver Tmax and time of first small bowel activity were not significantly different. There was no gallbladder Tmax value that could identify subsequent gallbladder ejection fraction grouping.

Conclusions: Although there were statistically significant differences between groups on dynamic imaging, subsequent ejection fraction could not be predicted and sCCK infusion was necessary to predict chronic acalculous cholecystitis. Further studies would be required to document robustness of this method.

005

COMPARISON OF EJECTION FRACTION (EF) OBTAINED FROM PLANAR VS. SPECT GATED BLOOD POOL STUDY (MUGA)

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Objective: To determine if EF obtained from SPECT GBP study can be used to replace EF obtained from planar GBP study over the clinical range of EF's and in normal, moderately abnormal and severely abnormal subgroups.

Methods: All patients referred for resting MUGA from January 2011 to Dec 2013 were performed prospectively with both planar and SPECT imaging. The EF's obtained from both techniques were compared. Correlation coefficients (r) for the whole group, and three subgroups with 1) EF>50%, 2) 35-50% and 3)<35% were calculated. Bland Altman analysis was also performed for all groups.

Results: 650 patients had MUGA. SPECT MUGA or SPECT EF could not be done for technical or clinical reasons in 78 patients. 572 patients had EF calculated by both methods. R was 0.857 for the whole group, 0.515 (n=147) for group1, 0.257 (n=242) for group 2 and 0.415 (n=183) for group 3. Bland Altman plots for all the groups showed no systemic difference between the planar and SPECT EF.

Conclusions: Our results showed good correlation of EF calculated from both methods over the whole range of EF. This is in accordance with previously reported results. However, previous reports in the literature did not show detailed comparison in different subgroups of EF. When the EF was divided into smaller clinically significant ranges, there is poor correlation between the two methods. Therefore, EF calculated from SPECT method cannot be used to replace the conventional planar method as indications for clinical intervention, e.g. insertion of ICD and prognostic evaluation were based on planar and not SPECT EF.

006

BUCCAL CAFFEINE FOR THE REVERSAL OF PERSANTINE FOLLOWING MYOCARDIAL PERFUSION IMAGING

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Purpose: The lack of availability of Aminophylline for the routine reversal of Persantine following myocardial perfusion imaging has necessitated the investigation of alternatives. Coffee is impractical. The effect of caffeine tablets is delayed due to slow absorption and energy drinks which are not pure caffeine seem unwise. There are cinnamon or spearmint flavoured caffeine buccal strips which deliver 40mg of caffeine. Buccal delivered caffeine is easily administered and rapidly absorbed. Buccal caffeine strips can be purchased at any local convenience store in Canada.

Methods: Nine-hundred and sixty-five consecutive patients undergoing Persantine MIBI scanning were studied. All patients gave signed, informed consent. Persantine was infused over 4 minutes and 2 minutes later a dose of Sestamibi was injected. Three minutes later the buccal caffeine was administered. Synergy strips deliver 40mg of caffeine via the buccal route. The patients were monitored with ECG and BP in the normal manner. Aminophylline was administered intravenously only if clinically indicated in doses of 50mg to a maximum dose of 200mg. ANOVA was used to detect differences between the means of multiple groups and Tukey-Kramer intercomparisons testing was performed when appropriate. A p value of <0.05 was considered significant.

Results: The mean age was 66.8 ± 10.9 years. Fifty-five of the 965 patients (5.7%) required Aminophylline to reverse the effects of the Persantine. There were no serious side effects observed from the buccal caffeine strips. The hemodynamic response to Persantine and the buccal caffeine is shown in Table 1. The heart rate and BP changes seen during Persantine administration are partially reversed by the buccal caffeine.

Conclusions: Buccal caffeine in a dose of 40mg is an acceptable alternative to intravenous Aminophylline for the

routine reversal of Persantine. One still needs Aminophylline available for the small number of patients (5.7%) who do not respond to buccal caffeine. The cost per patient for buccal caffeine is 50 cents compared to \$3.30 to \$8.20 for intravenous Aminophylline depending on the dose administered.

Table 1.

	Rest	Peak	Recovery	ANOVA
Heart rate (bpm)	67.1±12.4	88.1±13.8	78.5±12.4	<0.0001
Systolic BP (mmHg)	142.1±20.0	128.7±17.5	135.4±17.3	<0.0001

Eric Lepp Clinical Vignettes

EL-001

99M-TECHNETIUM-LABELED HEAT-DAMAGED RED BLOOD CELL (RBC) SCINTIGRAPHY TO IDENTIFY INTRAHEPATIC SPLENOSIS

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This case demonstrates the utility of 99m-technetium-labeled heat-damaged red blood cell (RBC) scintigraphy in the identification of ectopic splenic tissue. A 43 year old male admitted with a necrotizing pneumonia had an incidental, homogeneous liver lesion discovered on abdominal ultrasound (US) performed for mild right upper quadrant pain and slightly elevated liver enzymes. The subsequent computed tomography (CT) and magnetic resonance imaging (MRI) characterization were equivocal but raised the possibility of intrahepatic splenosis given that the patient had a traumatic splenectomy 29 years previously. Consequently, autologous 99m technetium-labeled heat-damaged RBC scintigraphy with single-photon emission computed tomography was performed in an attempt to avoid the planned biopsy. The scan revealed focal high-grade tracer uptake in the region of the liver corresponding to the known lesion and confirmed the diagnosis of intrahepatic splenosis.

Though splenosis, intrahepatic in this case, is a benign condition, correct identification is essential as misinterpretation can have a significant impact on patient management. However, differentiating intrahepatic splenosis from other hepatic lesions is difficult using US, CT, and MRI, as splenosis has no typical appearance. A high degree of suspicion, particularly in patients with previous splenic trauma or resection, on the part of clinicians and radiologists involved in these rare cases is necessary to avoid major surgery or invasive diagnostic approaches, as even percutaneous biopsies of splenic tissue are associated with a completely avoidable risk of hemorrhage. Therefore, as in this case, heat-damaged red blood cell scintigraphy should be recommended to confirm the diagnosis and prevent unnecessary invasive therapies (biopsies or surgical excision) from being performed.