Nuclear Medicine

Oral Presentations

0024

Lungs Detection in Ventilation and Perfusion Scintigraphy using Watershed Transform

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In lung ventilation and Perfusion scintigraphy, separating touching tissues in an image is one of the more difficult image processing operations. Because of the presence of speckle noise in these images affects edges and fine details which limit the contrast resolution and make diagnostic more difficult. Thus, with using segmentation based algorithm, choice of appropriate segmentation technique type for each circumstance becomes an essential task. The watershed transform is often applied to this problem. The watershed transform finds "catchment basins" and "watershed ridge lines" in an image by treating it as a surface where light pixels are high and dark pixels are low. Segmentation using the watershed transform works well if one can identify, or "mark," foreground objects and background locations. This algorithm was done on twenty-five patients. A watershed transform algorithm lungs segmentation method was proposed in this study. Proposed method is able to determine the lungs boundaries accurately. It is able to segment lung and improves radiological analysis and diagnosis.

0049

Image Quality Enhancement by the Reduction of Scattered Gamma Photons with Material Filter Technique in Tc-99m Cardiac SPECT: Phantom Study

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Abstract

Myocardial perfusion SPECT with Tc-99m is most commonly performed for the assessemnt of patients with suspected or known coronary artery disease (CAD). However, presence of scattered gamma photons in projection data degrade the image quality which in turn leads to inaccuracy in the diagnosis.

A new technique which uses flat sheet(s) of material(s) i.e., copper and aluminum 0.1mm thick and 550mm x 440mm in size as pre-filter(s) for scattered gamma photons was applied. Objectives of the study were to improve the image quality and enhance the accuracy in the measurement of the size of cold defect.

Carlson's phantom with cardiac insert which mimics the left ventricle was scanned using GE *Infinia* dual head gamma camera with LEHR collimator. Myocardial cold defect made from polystyrene was placed at the anterior side of the myocardial wall chamber. SPECT data acquisition parameters were selected similar to those which are applied in clinical myocardial perfusion studies. Data were acquired without and with material filter(s). Images were reconstructed with FBP applying Butterworth filter 0.40/cm cut off frequency and order 10. Chang's attenuation correction was applied.

SA, VLA and HLA views were visually analyzed and cold defect size was measured. Our findings showed that image quality and accuracy in defect size significantly improved (p<0.05) with both material filters as compared to without material filter.

It is concluded that the technique may have applications in clinical myocardial perfusion studies, however, requires more studies with other phantoms which simulate the human heart closely, e.g., Heart/Thorax Anthropomorphic Phantom.

0060

Vitamin D Deficiency and Myocardial Ischemia on Single-Photon Emission Computed Tomography (SPECT) on Saudi Patients at KAMC Between 2010-2012.

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Introduction: Coronary artery disease (CAD) is the most common type of heart diseases in the world. Recent studies suggested that vitamin D deficiency increases the risk of developing coronary artery disease. Most of the prior studies used coronary angiography to assess CAD. Moreover, there are no enough data about the association between CAD and low vitamin D levels in the Saudi population. In this study, Single-photon emission computed tomography was used to assess CAD.

Objective: Determine the association between Vitamin D deficiency and the degree of myocardial ischemia on Single-photon emission computed tomography (SPECT) in patients with suspected CAD.

Methods: This was an observational retrospective cross-sectional study in which charts of 285 KAMC patients were reviewed. Convenient sampling technique was used. Adult patients who underwent Nuclear SPECT and had their vitamin D levels measured within 6 months duration were included. Both genders were included. Data were entered and analyzed using SPSS.

Results: There was no correlation between vitamin D level as a continuous variable and the degree of ischemia (P value = 0.706). Perfusion defect (SSS3) and vitamin D <25nmol\l(vitD25) showed no correlation (P value = 0.776). The degree of significant perfusion defect (SSS7) based on vitamin D level as a continuous variable was not significant (p value = 0.197). SSS7 and vitD25 showed no correlation (p value = 0.187).

Conclusion: There was no correlation between vitamin D levels and perfusion defect. However, the P value shows a trend towards significance therefor this could be a sample size issue.

0072

Segmentation of Salivary Glands in Nuclear medicine Images Using Edge Detection Tools

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Recognition of the Salivary glands in nuclear medicine examination is very difficult because of unclear borders and existence of noise, which affects the spatial resolution and reduces the diagnostic values of those images Therefore, image-processing programs such as MatLab, has powerful tools, which can use for solving those problems. The Morphology tool frequently applied to this problem. In this paper, I used

entropyfilt function to create a texture image. This function returns an array where each output pixel contains the entropy value of the 9-by-9 neighborhood around the corresponding pixel in the salivary glands scintigraphy images. Threshold the rescaled image to segment the textures. A threshold value of 0.8 selected because it was roughly the intensity value of pixels along the boundary between the textures. The segmented images compare the binary image *rough Mask* to the original image. The quantitative results calculated using a measure of percentage match between ground truth and segmentation results. The percentage match (PM) measure was 99.33 (p <0.05) and Corresponding Ratio (CR) was -0.007 p <0.05). The proposed method is able to recognize the salivary glands accurately.

0078

Role of 18F-FDG PET/CT in staging and response to therapy assessment for primary parotid adamantinoma-like Ewing's sarcoma - First case report.Authors/Institution: AlSugair F[1], AlNaim A[2], AlSalloum R[2], Abouzeid M[2], Khan ZA[2][1]Imam Muhammad Bin Saud University, Riyadh. [2]Department of Radiology and Nuclear Medicine, King Faisal Specialist Hospital & Research Centre, Riyadh, Saudi Arabia.

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Aim/objectives:

Extra-skeletal Ewing's sarcoma are very rare tumours. Its "adamantinoma-like" novel histological variant is even rarer and has only been reported a few times involving the skeleton. Extra-skeletal occurrence of this variant has only been reported once before. We present the first case where 18F-FDG PET/CT was used both in staging and response to treatment assessment.

Methods and materials:

This 30 year old man initially presented to local general hospital with few months history of right parotid swelling. A parotid tumour was diagnosed on CT, and the mass was resected. Histopathology was initially locally reported as adenocarcinoma. Rapid recurrence and growth of the tumour led to referral to our tertiary care hospital. Histology review and additional fluorescence in situ hybridization (FISH) test confirmed the diagnosis of "adamantinoma-like Ewings' sarcoma". The patient was offered VAIA chemotherapy (combined chemotherapy protocol) with radiation therapy. Imaging included PET/CT scans pre-chemotherapy and also after 4 cycles. It was decided that if good response to chemotherapy was demonstrated, surgical resection could be offered.

Results:

Pre-chemotherapy PET/CT showed a large 8.5 x 8 cm markedly FDG avid (SUVmax 11.5) right parotid tumour. It reduced to 5.3 x 3 cm after 4 cycles of chemotherapy with significant reduction in FDG avidity (SUVmax 3.9). PET/CT did not show any other disease site. Patient also had resection in addition to radiation therapy.

Conclusion:

18F-FDG PET/CT is a useful technique for staging and response to therapy assessment in primary parotid adamantinoma-like Ewing's sarcoma and helps in making clinical management decisions.

0094

Early single institution experience in treating inoperable/metastatic neuroendocrine tumor (NET) using peptide receptor radionuclide therapy (PRRT).

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Methodology:

This is a retrospective study on selected consented patients of more than 18 years old.

13 patients, 7 males (54%) and 6 females (46%), mean age 43.3 years +/- 23 years, with histologically proven inoperable progressive metastatic NETs (9 patients G1/2 Tumors, 1 patient G3 and 3 patients G status were not available) have received 1-4 cycles of PRRT, 1-8 months period apart mostly 2 months apart (60%). Accumulative doses range from 3.2 GBq to 22.2 GBq. All patients received IV amino acids infusion for renal protection. Dosimetry was not performed on any of the patients.

Baseline radiological evaluations mostly CT scans and baseline Tc99m-octerotide SPECT or Ga-68 Dotatate PET-CT scans were performed to all patients and positive uptake were confirmed. Radiological evaluations by CT scans were performed between the cycles and after the end of the cycles. Response evaluation was made between the CT scans during and after the last cycle of PRRT with the baseline CT/MRI according to mRECIST criteria**.

Evaluation for acute renal toxicity (eGFR and Creatinine levels), liver toxicity (bilirubin level) and bone marrow suppression (WBC and platelets levels) were also performed after each cycle.

Results:

10 patients (77%) showed stable disease (SD). Three patients (23%) showed progressive disease (PD) in form of new lesions appearing after the 1st cycles. No patient showed complete remission (CR) or Partial response (PR).

6 patients (46%) had transient bone marrow suppression (low WBC and platelets) during the cycles.

0142

Utilization of SPECT CT in patients Undergoing Bone Scintigraphy; Our Initial Experience

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PURPOSE: Hybrid imaging is becoming an integral part of molecular imaging. This comes with its pros and cons. On one hand it can do functional and anatomical imaging in single setting while on the other side there are concerns for excess radiation dose. Here we evaluate the utilization pattern of SPECT-CT (Single Photon Emission Computed Tomography- Computed Tomography) in routine BS at our institute

METHODS: Study was approved by institutional review board. We did retrospective analysis of reports from BS that was performed at our institute during Dec 1st 2010 till November 30th 2012. Images were reviewed if required

RESULTS: 1100 BS were performed. Ages ranged between 3-100 years. There were 329 males (30%) and 771 females (70%). 204 BS were performed as three phase study while 896 BS were done as delayed whole body scans. 429 BS out of 1100 (39%) underwent further evaluation with SPECT CT. Out o these, 321 (75%) were part of tumor staging workup and 108 (25%) were part of osseous infection evaluation. Among tumor staging workup, 159 SPECT CTs (50%) were performed in patients with breast cancer followed by 30 (9%) prostate cancer patients

CONCLUSION: We conclude that utilization of SPECT CT at our institute is mostly for tumor staging workup, especially for breast cancer followed by osseous infection evaluation. This utilization pattern is noted because the osteolytic lesions from breast cancer and the complete delineation of osseous infectious process can be more evident by using SPECT CT in comparison to planar only imaging

Posters

0096

The effect of the acquisition and reconstruction parameters in the quality of tomographic SPECT images

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Many physical and technological factors degrade the SPECT quality images both qualitatively and quantitatively. For this, it is not always put into forward the technological advances to improve the performance of gamma camera system in terms of detection, collimation, reconstruction methods and physical correction effect. We have to master firstly, the choice of various acquisition and reconstruction parameters and applying the attenuation and scatter correction methods accessible to clinical cases, in order to optimize image quality and minimized the dose received by the patient.

In this work, an evaluation of qualitative and quantitative tomographic images is performed based on the acquisition parameters (counts per projection) and reconstruction parameters (filter type and associated cutoff frequency). In addition, methods for physical correction effects such as attenuation and scatter which degrading the image quality and alter quantification of the reconstructed slices are also presented. Two approaches of attenuation and scatter correction are implemented: the attenuation correction by Chang method with a filtered back projection reconstruction algorithm and scatter correction by the Jaszczak subtraction method. Our results are considered as such recommendation, which permits to determine the optimal counts per projection, the cutoff frequency associated with either Ramp or Butterworth filter. The application of Jaszczak subtraction method followed by Chang methods permits also to increase in the contrast and spatial resolution.

0112

"STUDY ON CORRELATION OF PROSTATE SPECIFIC ANTIGEN WITH METASTATIC BONE DISEASE IN PROSTATE CANCER ON SKELETAL SCINTIGRAPHY"

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To evaluate the ability of serum concentration of PSA between two cutting points considering it as a predictor of bone metastasis on bone scan in men with prostate cancer.
From Aug-2013 to Nov-2013, 42 consecutive patients with prostate cancer who underwent (Tc-99mMDP) whole body bone scan were prospectively analyzed. Patients who did not have a serum PSA

concentration available within 1 month before or after the time of performing the Tc-99m MDP whole body bone scan were excluded from this study. In addition, all patients necessarily have a pathological report available. Bony metastases were determined from the bone scan studies and no further correlation with histopathology or other imaging modalities were performed.

The mean age, mean PSA, and incidence of bone metastasis on bone scan were 68.35 years, 370.51 ng/mL and 19/42 (45.23%) respectively. From the 42 patients 19(45.23%) presented positive bone scan examination for the presence of bone metastasis. when the cutting point adopted for PSA serum concentration was 10ng/mL, a NPV for bone metastasis was 95% with sensitivity rates 94.74% and the PPV and specificity of the method were 56.53% and 43.48% respectively. When the cutting point of PSA serum concentration was 20ng/mL the observed results for PPV and specificity were (78.27% and 65.22% respectively) whereas NPV and sensitivity stood (100% and 95%) respectively.

We conclude that serum PSA concentration of higher than 20ng/mL was the more accurate cutting point than a serum concentration of PSA higher than 10ng/mL to predict metastasis on bone scan.

0116

Gate Monte Carlo Simulation for Dual Head Gamma Camera

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In recent decades, several Monte Carlo codes have been developed for simulation in medical physics. One of these codes is Gate, which has a number of advanced features for simulation in medical imaging and radiotherapy. In this work, Gate was used to simulate Nucline Spirit-Mediso dual head Gamma Camera, equipped with low energy general purpose LEGP collimators. The model was used to evaluate the effect of distance on spatial resolution, sensitivity, and the effect of source dimension on sensitivity. In spatial resolution, two line sources of Tc^{99m} were used at distances of 5, 10, 15, 20, 22, 27, 32 and 37 cm from collimator surface. For sensitivity circular surface sources of Tc^{99m} with radius of 2.5 and 5 cm were used at distance of 10, 15 and 20 cm from collimator surface.

Regarding the spatial resolution, FWHM was found to be 5.76, 7.73, 10.7, 13.8, 14.01, 16.91, 19.75 and 21.9 mm at the above-mentioned distances of spatial resolution respectively. The calculated sensitivity found to be 11.304 CPS/μCi, 11.274 CPS/μCi and 11.268 CPS/μCi at the mentioned sensitivity distances respectively, source with radius 2.5 cm, while 11.258 CPS/μCi, 11.235 CPS/μCi and 11.232 CPS/μCi at same distances with source with radius 5 cm. For validation, FWHM calculated at 10cm was compared with experimental results and shows the variation of 13%. In general, simulation result found to be acceptable and agreeable with the basics and fundamentals of nuclear medicine imaging; the model can be used in different issues of research and training.

0121

An overview of coded aperture families suitable for imagining with position sensitive detectors

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Breast Cancer is a life threatening disease and thus, considered one of the most common form of cancer among women in Saudi. The gold standard imaging method for detection is mammography. However, it suffers from some limitations, and are often uncomfortable, stressful, and increase a patient's radiation exposure.

Alternatively, a complementary promising imaging technique namely scintimammography (SM) was recently introduced as a second line method for woman with dense breast. This technique is generally performed using high-resolution parallel-hole collimators with Anger cameras. SM has some clinical limitations as it is less reliable for detecting small (< 1 cm in diameter) lesions. The upcoming work from this group is try to get rid of these limitations demonstrating the use of Coded Aperture (CA) instead of a collimator, coupled to a standard clinical gamma camera for breast tumor imaging.

This work introduces the concept of (CA) imaging and provides an historical background of the different types of CA. Then briefly describe most of the CA families with their mathematical imaging properties. Moreover, it introduces their generation rules and correlation properties. This include the next arrays, Fresnel zone plate, random array, non-redundant arrays, L shape geometric array, X shape geometric, uniformly redundant, modified uniformly redundant, mosaic uniformly redundant and no-Two-Hole-Touching.

Finally, This work closed with the introduction to the principle of pinhole camera to appreciate the theory and the formation of coded image.

0122

Coded Aperture imagining with gamma camera

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Scintimammography (SM) was recently introduced as a second line method for woman with dense breast. This technique is generally performed using high-resolution parallel-hole collimators with Anger cameras.

SM has some clinical limitations as it is less reliable for detecting small (< 1 cm in diameter) lesions. This work is to get rid of these limitations demonstrating the use of Coded Aperture (CA) instead of a collimator, coupled to a standard clinical gamma camera for breast tumor imaging.

The work begins with introduction to the principle of pinhole camera to appreciate the theory and the formation of coded image. This work highlights the coded aperture camera geometries describing the design methods of the proposed approach. It discusses the mask camera configuration and design with emphases on the size, the open fraction and the Field of View (FoV). The reconstruction methods used to decode and recover the encoded image close the work.

0128

Using Basic Morphology Tools in Improvement of Kidneys Detection

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In renal scintigraphy, detecting the borders of kidneys in an image is one of the more difficult image processing operations. Because of the presence of speckle noise in these images affects edges and fine details which limit the contrast resolution and make diagnostic more difficult. Thus, with using basic morphology based algorithm, choice of appropriate technique type for each circumstance becomes an essential task. The segmentation transform is often applied to this problem. The segmentation transform finds "catchment basins" and "watershed ridge lines" in an image by treating it as a surface where light

pixels are high and dark pixels are low. Segmentation using the watershed transform works well if one can identify, or "mark," foreground objects and background locations. This algorithm was done on fifty renal scintograms. A watershed transform Algorithm kidneys segmentation method was proposed in this study. Proposed method is able to determine the liver boundaries accurately. It is able to segment liver and improves radiological analysis and diagnosis.

0136

VALUE OF SPECT/CT IN PREOPERTIVE ASSESSMENT OF PATIENTS WITH CONDYLAR HYPERPLASIA *MAISA EHSAN TAYEB   IBRAHIM ELTAYEB MESHAL MELBARY BOTHINA ABDALSHAKOR*

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Introduction:

Abnormalities in mandibular growth can result in considerable facial abnormality and asymmetry.It may be congenital or acquired and often has functional, esthetic, and social consequences.For clinician determining which is the normal versus the abnormal side and if the asymmetric growth pattern is progressive (active) or stable (quiescent) is of crucial value in treatment planning.

This review exhibit visual and quantitative assesment in patients having unilateral condylar hyperplasia. Right & left condylar uptakes were asymetrical and some difference (above10%) between right and left condylar uptake was seen.

SPECT/CT Tc^{99m} MDP images in 21 years old male reveal active right condylar hyperplasia with right to left ratio of 1.79.Tc99 MDP SPECT/CT images of 31 years old female patient shows active right condylar hyperplasia with Right to left condoyle ratio of 1.85

Conclusion:

Tc^{99m}-MDP SPECT / CT provides a measureable method for evaluating mandibular condylar uptake as a reflection of the activity of mandibular growth. The maximum pixel value of a 2-D ROI using internal standard and the right to left percentage of the condylar uptake provide measureable evaluation of patients with mandibular asymmetry.

An enlarged but inactive condyle is usually left intact provided there are no functional abnormalities such as decreased motion. The mandibular asymmetry is treated by orthognathic reconstructive surgery to align the mandible and to correct the occlusion. Conversely, treatment of active or progressive condylar hyperplasia consists of a high partial condylectomy to arrest growth.