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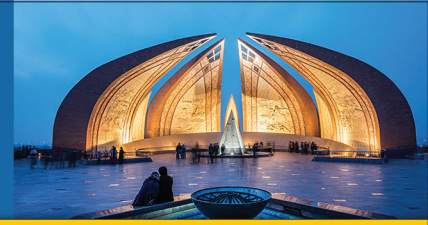


ABSTRACT BOOK
October 2023





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ARTIFICIAL INTELLIGENCE-BASED CLASSIFICATION OF THYROID SCINTIGRAPHY

AWAIS UR RAHMAN - CENAR

Abstract

Introduction: In the realm of thyroid scintigraphy, this research endeavors to harness the potential of Artificial Intelligence (AI) to classify scintigraphy images into distinct diagnostic categories, including Normal Thyroid, Diffused Goiter, Thyroiditis, Cold Nodules, and Hot Nodules. This work proposes a methodology to distinguish the thyroid gland by employing feature extraction technique on scintigraphical images and using those regions-of-interest (ROIs) to classify them using Support Vector Machine (SVM). We aim to mitigate the inherent variability and human error in diagnosis. Imaging data is to be extracted from CENAR nuclear medicine gamma camera scans and MATLAB is to be used for implementation of the research. This study offers a pioneering approach to enhance the accuracy and consistency of thyroid diagnosis, ultimately providing valuable support to nuclear physicians in their decision-making process and potentially revolutionizing the field of medical imaging.

Research Objectives: The primary objective of this study is to harness AI tools to present a second opinion to nuclear physicians to minimize human error in the diagnosis of thyroid disorders based on scintigraphy. Specifically, this research aims to:

1. Extract ROI (Region of Interest) using feature extraction technique from thyroid scintigraphy images.
2. Implement noise reduction techniques to enhance image quality.
3. Utilize Support Vector Machine (SVM) as a classifier to categorize thyroid scans into Normal, Diffuse Goiter, Thyroiditis, Cold Nodules, or Hot Nodules.
4. Demonstrate the practicality and effectiveness of our AI-based system in providing accurate diagnostic classifications.

Discussion: The integration of AI into thyroid scintigraphy analysis offers the potential to revolutionize the field by providing nuclear physicians with valuable second opinions, ultimately improving patient care. This research not only contributes to minimizing diagnostic errors but also showcases the power of AI in medical imaging.

Conclusion: In a world where accurate and timely diagnoses are crucial, our research highlights the promising potential of AI in classifying thyroid scintigraphy images. By reducing human error and offering consistent diagnostic support, this approach holds the promise of enhancing patient outcomes and healthcare efficiency.

Keywords: Thyroid Scintigraphy, Artificial Intelligence, Support Vector Machine, Diagnosis, ROI Techniques, Medical Imaging, Nuclear Medicine, MATLAB.

Novelty

Use of Artificial Intelligence for Diagnosis using Thyroid Scans



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ASSESSMENT OF MOLYBDENUM CONCENTRATION LEVEL IN ⁹⁹MO/^{99m}Tc GENERATORS (PAKGEN): IRNUM EXPERIENCE

IRFAN ALI - IRNUM

Abstract

The purpose of this study is to assess the contamination level of Mo-99 in the eluted activity of ^{99m}Tc used for the diagnostic procedures at Institute of Nuclear Medicine, Oncology and Radiotherapy (IRNUM), Peshawar, Pakistan prior to its administration to patients. The Mo-99 concentration in ^{99m}Tc elutes was assessed for 250 generators used within five years (From June 2018 to June 2023) at IRNUM. The Mo-99 impurity concentration was measured with Capintech permissible range. However, for only three (03) out of 250 generators (1.11, 0.98, 1.09% respectively) the Mo-99 concentration were high, which were handled and removed using standard procedure to decrease the impurity of Mo-99.

It was concluded that Molybdenum breakthrough test is a mandatory requirement and pre-requisite for ^{99m}Tc elutes on routine basis to improve the image quality and reduce the patient unnecessary dose.

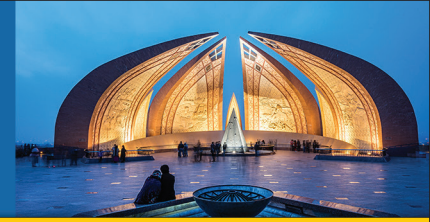
Novelty

MBT test is a mandatory requirement and pre-requisite for ^{99m}Tc elutes on routine basis to improve the image quality and decrease the patient unwanted dose.
Inc.; dose calibrator and standard canister after the elution of all these generators.

It was observed that for most of the generators (98.8%) the level of Mo-99 concentration was within the.



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ASSOCIATION BETWEEN DEXA SCAN RESULTS, HYPOTHYROIDISM, REDUCED VITAMIN D LEVELS, AND THALASSEMIA: A COMPARATIVE ANALYSIS

AYESHA AMMAR - NORI

Abstract

Background: This study investigates the complex relationship between DEXA scan results, hypothyroidism, reduced vitamin D levels, and thalassemia, with a particular focus on a cohort of 51 thalassemia patients and an age- and sex-matched control group of 32 individuals. The aim is to elucidate the potential impact of these factors on bone health and overall well-being in these two distinct populations.

Methods: We conducted a retrospective analysis of patient records, comprising 51 individuals diagnosed with thalassemia and 32 age- and sex-matched controls, who underwent DEXA scans for bone density assessment. Data encompassed demographic information, medical history, DEXA scan results, thyroid function tests, vitamin D levels, and thalassemia subtype.

Results: Our findings revealed a substantial association between thalassemia and altered DEXA scan results, suggesting a heightened risk of compromised bone health in thalassemia patients. Specifically, individuals with thalassemia exhibited significantly lower T-scores, with a higher prevalence of osteopenia and osteoporosis compared to the control group especially in the lumbar spine. Hypothyroidism was more prevalent among thalassemia patients, further exacerbating the risk of bone-related complications. Worsening of thyroid function was observed in 45% of the studied thalassemic patients by the age of 18 years. Additionally, vitamin D deficiency was highly prevalent in both thalassemia patients and controls, with thalassemia patients demonstrating lower bone density despite comparable vitamin D levels.

Conclusion: This comparative analysis underscores the intricate interplay between DEXA scan results, hypothyroidism, reduced vitamin D levels, and thalassemia in a cohort of 51 thalassemia patients and 32 age- and sex-matched controls. Thalassemia patients, despite similar vitamin D status, exhibited lower bone density, highlighting the potential impact of thalassemia itself on bone health. Healthcare providers should be vigilant in monitoring and managing the bone health of thalassemia patients, considering both vitamin D levels and thyroid function. Future research should delve into the specific mechanisms underlying these associations and explore tailored interventions to optimize bone health in this vulnerable population.



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CLINICAL UTILITY OF BRAF AND PTERT MUTATIONS IN PRECISION MANAGEMENT OF PAPILLARY THYROID CANCER

HAMID BASHIR - PINUM

Abstract

Papillary thyroid cancer (PTC) is the most prevalent and indolent thyroid cancer, but still, around 20% of cases will develop regional recurrence or distant metastasis. Isolated or coexistent BRAF V600E and pTERT mutations in thyroid cancer are associated with poor clinical outcomes. The prior knowledge of BRAFV600E and pTERT mutation may help to identify the cases that may recur or become refractory to standard Radioactive iodine treatment. Such cases could be treated initially with complete disease eradication through extensive surgery followed by maximum permissible high-dose radioactive iodine ablation and vigilant follow-up. Conventional risk assessment followed by genotype-based risk assessment can help in the precision management of aggressive thyroid cancers.

Novelty

The emerging role of genomic biomarkers in the treatment of thyroid cancer will be discussed



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DIAGNOSTIC ACCURACY OF TC99M-SESTAMIBI IN DIFFERENTIATING BENIGN VS. MALIGNANT RENAL MASSES

ZEESHAN - AFIP

Abstract

Objective: To assess the role of pre-operative Tc-99m sestamibi scintigraphy in differentiating benign renal masses from malignant renal masses.

Study designs: Descriptive cross-sectional study

Place and duration of study: Nuclear Medical Centre, Armed Forces Institute of Pathology Rawalpindi from 1st June 2022 to 1st June 2023.

Methodology: A total of 41 patients with T1 solid renal tumours who were eligible for undergoing surgery or suitable for biopsy underwent Tc-99m sestamibi scintigraphy during study duration. Tc-99m sestamibi scintigraphy findings were correlated with post-operative histopathology results to determine accuracy of scintigraphic study.

Results: Out of 41 patients, 24 (58.5%) were men and 17 (41.5%) with a mean age 54.39 ± 13.28 years. Out of 41 patients, 24 (58.5%) had clear cell RCC, 5 (12.2%) had papillary RCC, 3 (7.3%) had chromophobe RCC, 2 (4.9%) had oncocytic papillary RCC, 5 (12.2%) had oncocytoma and 2 (4.9%) had lipid poor angiomyolipoma variant on histopathology. Overall 7 (17.07%) patients had benign pathology. Tc-99m Sestamibi SPECT/CT correctly identified all benign lesions (oncocytoma and lipid poor angiomyolipoma) and two variants of malignant pathology (chromophobe and oncocytic papillary RCC) yielding a sensitivity of 100% while specificity of 85.29% in detecting benign lesions. There was significant correlation between positive Tc-99m sestamibi findings and benign pathology with a p value < 0.001 .

Conclusions: Tc-99m sestamibi scintigraphy plays a significant role in pre-operative evaluation of renal masses and offers a non-invasive modality to help differentiate benign and malignant renal masses.

Keywords: Oncocytoma, Renal cell carcinoma, Tc-99m sestamibi, SPECT/CT.



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EMERGING ROLE OF ARTIFICIAL INTELLIGENCE IN CYTOLOGY OF PAPILLARY THYROID CARCINOMA (PTC)

TANIA JABBAR - PINUM

Abstract

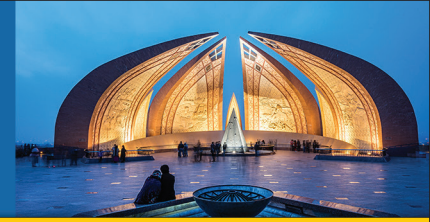
Accurate cytopathological identification of Papillary Thyroid Carcinoma (PTC) is important for reducing costs and for effective patient management. Conventional visual inspection of cytopathology slides is time-consuming, subjective with high inter-observer variability, and sometimes causes sub-optimal treatment due to false-positive and false-negative results. Deep learning (Artificial Intelligence AI in Medical Sciences) has revolutionized the field of cytology. It has gone a step forward in cancer screening by offering a powerful tool for the detection and diagnosis of papillary thyroid carcinoma (PTC), the most common type of thyroid cancer. Deep learning models have been successfully utilized for Bethesda category 2 (benign) and Bethesda category 6 (Malignant), for central lymph node metastasis, for tall cell variant, and for fast screening of Papanicolaou-stained thyroid fine needle aspiration (FNA)/ThinPrep (TP) cytological slides. Collectively, these studies demonstrate the immense potential of deep learning algorithms in improving the accuracy, efficiency, and specific diagnostic tasks related to PTC cytology. Integration of deep learning approaches holds promise for advancing PTC diagnosis and ultimately benefiting patients. However, developing countries like Pakistan are lagging in the implementation of AI-based solutions in healthcare. This review explores existing literature across the globe regarding the utilization of deep learning in cytology. Apart from the usefulness of AI this review also sheds light on challenges and opportunities for adopting AI in low and middle-income countries.

Novelty

The presentation is focused on the application of Artificial Intelligence in the cytology of Papillary Thyroid Carcinoma. The review also sheds light on the usefulness of AI on challenges and opportunities for adopting AI in low and middle-income countries



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EXPERIENCE OF TARGETED RADIATION THERAPY IN NEUROENDOCRINE TUMOURS (NETS) USING LUTITIUM-177 DOTATATE IN NORI

WAJIHA NASIR - NORI

Abstract

Neuroendocrine tumours (NETs) arise from epithelial endocrine cells distributed throughout the aerodigestive tract and pancreas. 80% of the tumours express somatostatin receptors (SSTRs). Management principle of NET involves removal of localized and limited metastatic disease. Advanced disease involves control of hormone secretion, tumour growth and to minimize toxicity. Octreotide, a somatostatin analogue binding to SSTR_{2,5} is used in management of NETs. Lu¹⁷⁷DOTA-Octreotide (DOTATATE) is a radioactive isotope, conjugated to somatostatin analogue is approved on 29th Jan 2018 by FDA to treat patients with grade 1-2 advanced GEP NET, showing disease progression on octreotide LAR 30 and having somatostatin receptor positive nuclear scan.

In NORI from 30th April 2019 till date 12 patients (7 male and 5 female) with age range 29 years to 74 years were given Lu¹⁷⁷DOTATATE (dose ranges from 100mCi -204 mCi). 10 patients had NET GRADE 1,2,3. 8 patients had NET from GEP origin and 2 had non GEP origin. 2 patients were diagnosed cases of metastatic paragangliomas. So far 5 patients were single cycle of therapy. 2 patients had received 2 cycles, 2 received 3 cycles and 2 patients had received 4 doses and 1 patient got 6 cycles. All patients had GFR more than 54 ml/min before therapy.

Out of those 7 patients who got more than one therapy, regression of disease is noted in 4 patients, progression is seen in 2 patients while static disease is seen in one patient having diagnosis of paraganglioma (died after 2 years of 4th cycle). Those 5 patients who got single therapy 4 patients died within 4 months of PRRT while one patient lost follow up and is well now subjectively.

In this 6 out of 12 patients died. In order to reduce mortality rate, selection criteria of patients, baseline work up and follow up instructions should be given more emphasis. In future PRRT can play a hopeful role of management of NETs.

Novelty

PRRT for NETs is recently started in NORI and data is first time compiled for future improvement.



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FORMULATION, RADIOBIOLOGICAL EVALUATION, QC AND CLINICAL APPLICATIONS OF LU177 HYDROXY APATITE INTENDED FOR RADIOSYNOVECTOMY.

Abstract

Background:

The emerging Lutetium-177 (^{177}Lu) has opened new arenas in the field of theranostic Nuclear Medicine. The therapeutic potentials of ^{177}Lu can be well explored by labeling it with Hydroxy Apatite. Dependence of the radio labeling yields on incubation time, temperature, pH and centrifugation was examined.

Aims:

The aim of this study was to formulate and evaluate ^{177}Lu HA for radiosynoviorthesis applications.

Material and Method:

HA suspension was labeled with ^{177}Lu in basic media under aseptic conditions. Radiochemical purity of the labeled product was carried out by paper Chromatography techniques. The stability of ^{177}Lu HA was observed at room temperature for 24 hrs in saline, in blood serum and synovial fluid for up to 48hrs. The radiopharmaceutical was then injected into the knee joints of patients. The biodistribution images were acquired at 1hr, 24hrs and 48hrs post injection using GE NM/CT Gamma Camera.

Results:

The labeling efficiency of ^{177}Lu HA was $96.5 \pm 0.5\%$ at the conditions of HA 7.5mg, 0.1ml of 0.5M NaHCO_3 , ascorbic acid 10mg at pH 8.5. After centrifugation, the radiochemical purity (RCP) was $98.95 \pm 0.5\%$. The biodistribution images showed no leakage of the tracer into the surrounding tissues or regional lymph node.

Conclusion:

Higher labeling efficiency, long time stability and simple procedure make ^{177}Lu HA, a suitable candidate for the treatment of chronic inflammatory, Hemophilia and other intra-cavitary therapy applica-tio



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HIGHER CARDIAC EVENTS WITH IMPAIRED EXERCISE TOLERANCE (METS <7) AND LOWER EJECTION FRACTION <45% IN PATIENTS WITH MEDIUM TO LARGE SIZE FIXED PERFUSION DEFECT(S) ON GATED MYOCARDIAL PERFUSION SCINTIGRAPHY WITH PRIOR CORONARY REVASCULARIZATION.

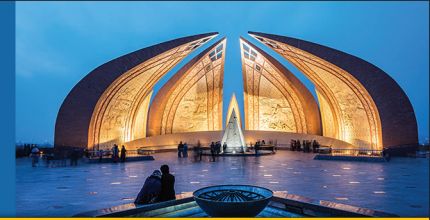
MASEEH US ZAMAN - AKUH

Abstract

Introduction: This prospective study was carried out to find the predictive value of fixed perfusion defect(s) for future cardiac events on follow-up gated myocardial perfusion imaging (GMPI) after coronary revascularization (graft surgery and coronary stenting). **Methodology:** Total 330 patients who were referred for GMPI for chest pain evaluation after coronary revascularization from June 2015 till December 2016 were selected. 186 out of 330 patients with fixed perfusion defects on GMPI were included as study population. These patients were followed for 06 years for cardiac events both fatal myocardial infarction (FMI) and nonfatal myocardial infarction (NFMI). Follow up was not available in 11 patients, leaving a cohort of 175 participants. Patients were subdivided according to stress protocol (Bruce protocol in 84 and vasodilators in 91 patients). **Results:** Mean age of population was 58 years without statistically significant difference in age, body mass index, diabetes mellitus, hypertension, dyslipidemia, family history and smoking in exercise and vasodilator stress groups (except male dominance in exercise group). No significant Odd ratio (OR) was found for cardiac events in exercise and vasodilators groups with medium to large size fixed perfusion defects on GMPI. In exercise group, metabolic equivalent of task (METS) less than 7 (METS <7) had significant OR and Hazard ratio for future cardiac events in patients with medium to large size perfusion defects as an independent factor (OR=9; CI=1.07-75.5, HR=8.61; CI=2.49-29.75 $p<0.05$; and OR=10.1) and as confounding factor for ejection fraction less than 45% (CI=1.13-90.9; HR=5.66; CI=1.76-18.14; $p<0.05$). **Conclusions:** Medium to large sized fixed perfusion defects with LVEF <45% are associated with higher cardiac events rate in patients after coronary revascularization. A lower exercise effort tolerance (<7 METS) is an independent and confounding factor for patients with LVEF <45%. Exercise GMPI has better predictive value for future cardiac events in patients with coronary revascularization.

Novelty

MPI is a valuable tool for risk stratification and prediction of future fatal cardiac events after revascularization, however association between the severity of MPI abnormality and effort tolerance after revascularization is unique in this study to predict future outcome in local population.



ASSESSMENT OF INDIVIDUAL RENAL FUNCTION BY ABSOLUTE RENAL UPTAKE USING ^{99m}Tc-MAG3 RENOGRAPHY AND ITS COMPARISON WITH ^{99m}Tc-DMSA

HUSNAIN DILAWAR - KIRAN

ABSTRACT

Introduction: Absolute renal uptake (ARU %) is a quantitative parameter to assess renal function. It is actual uptake by functional renal tissue. It is independent of contralateral kidney function. Calculation of split renal function (SRF %) is widely used in daily clinical practice; however it does not provide exact information regarding the functional status of each kidney separately, as it gives information about relative renal function.

Aim: Purpose of this study is to calculate the value of absolute renal uptake (ARU %) in subjects by using ^{99m}Tc MAG3 and ^{99m}Tc DMSA scan and compare the values.

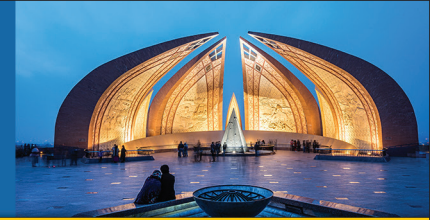
Materials and Methods: Absolute renal uptake is calculated by using ^{99m}Tc MAG3 and ^{99m}Tc DMSA in renal scintigraphy, Itoh and Tauex kidney depth methods used respectively. 40 adult patients of both genders were included with at least one normal functioning kidney. All enrolled patients underwent ^{99m}Tc MAG3 and ^{99m}Tc DMSA respectively.

Results: The values of ARU (%) calculated separately in selected patients n=40, (left =17, Right =23 normal functioning kidneys) by MAG3 and DMSA. Absolute renal uptake (%) of ^{99m}Tc MAG-3 in left kidneys found to be 15.2 ± 3.4 , with split renal function 79.2 ± 14.7 and ARU (%) in right kidneys 16.2 ± 3.4 with split renal function 77.5 ± 19 . Absolute renal uptake of ^{99m}Tc DMSA in left kidneys was 17.5 ± 3.2 , and in right kidneys 17.9 ± 4.5 with split renal function 81.8 ± 10.7 and 79.3 ± 13.8 for left and right kidney respectively. Statistical analysis showed strong Pearson correlation.

Conclusion: Absolute renal uptake % found to be more reliable in cases of bilateral compromised kidneys. ARU (%) calculated by ^{99m}Tc MAG-3 solely can be used as predictor of renal function. Use of ^{99m}Tc MAG-3 has more advantages than ^{99m}Tc DMSA alone in renal scintigraphy as it dynamic scintigraphy gives less radiation burden to patient, more information regarding renal function and shorter stay time at hospital in comparison to static renal imaging. SRF % is less reliable than ARU (%).

Novelty

Renal function usually assessed by split renal function which is relative function and depends on functioning of contralateral kidney, so the clinical utility of absolute renal function is very important as it is independent of counterpart kidney and can be easily assessed by dynamic renal scan with the help of ^{99m}Tc-MAG3 as well.



MANAGEMENT AND LONG TERM OUTCOME OF PATIENTS OF PAPILLARY THYROID MICROCARCINOMA –A SINGLE CENTER EXPERIENCE

KAHKASHAN MIR - NORI

Abstract

Background: Papillary thyroid microcarcinoma (PTMC) is a specific subgroup of papillary thyroid carcinoma (PTC) and defined as a thyroid cancer that is < 1 cm in size. Microcarcinomas of the thyroid gland rarely grow or spread, therefore treatment of PTMC is always a debatable common issue, despite having clear guidelines about its management. Current data suggests that these tumors can be managed equally well by either immediate surgical excision or active surveillance with or without surgery at a later stage. Literature review showed that patients with PTMC who undergo surgery with or without radioiodine ablation, have a risk of recurrence at 10–12 years ranging from 0.5% to 1% for a single focus and increases to 5% when multiple foci or clinical lymph node metastases are initially diagnosed. Distant metastases occur with a frequency of less than 1%. Therefore there is always a debate between active surveillance (AS) as an alternative treatment to immediate surgery and Radioactive I-131 for PTMC.

Aims and objectives: The purpose of this study was to investigate whether AS alone is a sufficient alternative to surgery in achieving significant survival benefits in patients with PTMC in Pakistani population or it requires surgery and/or Radioactive I-131 treatment because of its progression to mets in the later stage of disease.

Materials and Methods: Total 689 patients were analyzed retrospectively from January 2018 to December 2022. 74 patients of PTMC were included. They were divided according to conservative approach and surgical and Radioactive I-131 treatments, based on metastasis at the time of presentation. Their progression free survival was assessed, based on gender, age, size, multi focality, stimulated tumor markers, nodal or distant mets at the time of presentation and family history of thyroid cancers. Statistical analysis of data was done to assess the prognosis of PTMC in AS and surgically and I-131 RAI treated patients.

Results: A total of 73 patients were extracted from the database. Data analysis showed that multifocality of tumor at the time of presentation, progressive increase in stimulated tumor markers from baseline levels and nodal presentation, were the most important factor affecting progression free survival of patients in both groups. There is no affect of age, gender, size and family history on PFS. Conclusion: For patients with PTMC, AS is a feasible management strategy. However, both immediate surgery and an active surveillance are safe and effective in the hands of qualified practitioners. It is necessary to conduct more large-scale prospective randomized trials to further confirm this approach.

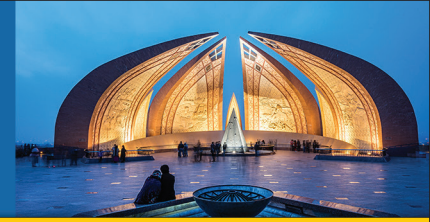
Key words: Papillary Thyroid Microcarcinoma, active surveillance

Novelty

Different approaches towards the Management of PTMC



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UTILITY OF MAA SPECT/CT PERFUSION SCINTIGRAPHY IN THE DIAGNOSIS OF PULMONARY EMBOLISM; OUR EXPERIENCE

KHALIDA KHURSHEED - NORI

Abstract

Both pulmonary CT angiography (CTPA) and ventilation/perfusion scintigraphy (V/P) are used to diagnose acute pulmonary embolism (PE). Recent years have seen advancements in both methods. In place of the planar technique, the single photon emission CT (SPECT) method is now widely used in nuclear medicine clinics to diagnose PE. It has been demonstrated that SPECT has fewer undecided outcomes and a greater diagnostic value. The most recent development is the use of a hybrid tomography to combine a low-dose CT scan with a Perfusion SPECT scan. SPECT/CT showed the best diagnostic accuracies for PE. The sensitivity and specificity of perfusion SPECT/CT was 90%, 70% respectively. The perfusion SPECT/CT has an excellent diagnostic performance and should therefore be considered in the work up of PE in most cases.

Novelty

To see the role of SPECT/CT perfusion scintigraphy alone for the diagnosis of Pulmonary embolism



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PRETEST LIKELIHOOD OF CORONARY ARTERY DISEASE IN MYOCARDIAL PERFUSION SCAN IN COMPARISON TO MPS RESULTS; AS STUDIED IN OUR POPULATION

FARZEEN ZAHRA - NORI

Abstract

Pretest likelihood of coronary artery disease in case of myocardial perfusion scan plays a pivotal role not only in setting appropriate use criteria (indication & referral) for MPS but also in interpretation of the study results and in predicting clinical outcome such as ten year risk of a cardiac event. Most of the guidelines, as highly esteemed as ACC/AHA, SNMMI, ACR, ANM, NASCI & IAEA Guidelines for MPS also incorporate this information. Internationally, it is recognized that the post-test likelihood of disease is linearly related to pretest one based on many studies. However, all this is based on data collected from populations with entirely different features from ours, so applying the same pretest likelihood criteria may not yield accurate results here. Thus this study was conducted to analyze the pretest likelihood of CAD in comparison to MPS results obtained in our local population. In this study, data was collected retrospectively, of the patients who underwent MPS in our institute in last 2 years. Their pretest likelihood of having CAD was calculated using IAEA guidelines (that use age, sex and primary symptom), which was then compared to their MPS result. A total of 878 patients (480 males, 398 females, age 58 ± 32 y) had MPS (1631 scans) in last 02 years in NORI. Of these 58% males and 30% females with high likelihood, 81% males & 54% females with intermediate, 80% males & 42% females with low likelihood and 0% male & 20% females with very low likelihood had positive MPS. Gender dependence was observed in results. Some interesting groups were also identified such as those females with typical angina having high pretest likelihood showing negative MPS. It was also observed that ischemic myocardial segments' location was also important in inducing symptoms used for pretest stratification.

Novelty

No local study has been conducted so far to analyse the pretest likely hood of coronary artery disease in comparison to the scan outcome. It is necessary to know how this likelihood criteria works in our given set up. It has significant implication regarding indication and appropriate use criteria and interpretation of scan result and prognostication.



QUANTITATIVE ANALYSIS IN PARATHYROID SCINTIGRAPHY: [99MTC]TC-MIBI SPECT/CT A TOOL FOR NONINVASIVE CHARACTERIZATION OF PARATHYROID LESIONS

SIDRA BASHIR - DINAR

Abstract

This prospective, small sample study aims at exploring the potential of quantitative SUV analysis of dual-phase [99mTc]Tc-MIBI SPECT/CT for preoperative localization and differentiation of hyper-functioning parathyroid lesions (PL).

Materials and methods

40 hyperparathyroid patients (M: F; 12:28, Mean Age \pm SD, 40.92 ± 13.48 years) underwent SPECT/CT scintigraphy with neck and mediastinum in field of view at early (90 min) and delayed (180 min) post injection (p.i.) of [99mTc] Tc-MIBI. Images were analyzed for PL localization. Maximum and mean SUV (SUVmax; SUVmean) at 90 and 180 min p.i. for PL as well as reference thyroid tissue were measured. PL classified as adenomas, carcinoma and hyperplasia on the basis of SUV were correlated with post-surgical histopathology. Statistical analysis with paired t-test was used to measure the significance of the difference in SUV values of adenoma and hyperplasia with reference thyroid tissue.

Results

SPECT/CT identified PL in 25 out of 40 patients. Using SUVmax and SUVmean, PL were labeled as hyperplasia (02), adenomas (22), and carcinoma (01). Both SUV values showed a decline at 180 min p.i. as compared to 90 min p.i., but SUVmax was considered better for lesion characterization. SUVmax (g/mL) of carcinoma, adenomas, hyperplasia, and reference thyroid tissue were 16.656 , 6.933 ± 2.037 , 2.788 ± 0.279 , and 1.117 ± 0.221 at 90 min p.i. Significant difference ($P < 0.0001$) of SUVmax between adenomas and reference thyroid tissue but no significant difference ($P = 1.000$) between hyperplasia and reference thyroid tissue at both time points was found. SUVmax at 90 min p.i. for carcinoma (16.656 g/ml) was also found higher than adenoma and hyperplasia. Parathyroid adenomas and carcinoma were confirmed on post-surgical histopathology of lesions in respective patients however two patients with hyperplasia could not undergo surgery.

Conclusion

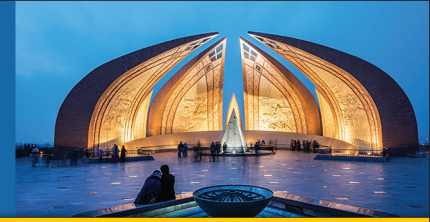
SUVmax at 90 min p.i. of [99mTc]Tc-MIBI SPECT/CT was found to be a good quantitative parameter for PL localization and their noninvasive image-based classification.

Novelty

SUV calculation of lesion on SPECT/CT



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THE ROLE OF A NUCLEAR MEDICINE TECHNOLOGIST IN RADIOSYNOVECTOMY

MAHEEN - IRNUM

Abstract

This research poster underscores the indispensable role of nuclear medicine technologists in the specialized medical intervention known as radiosynovectomy. Radiosynovectomy, a minimally invasive treatment for inflammatory joint conditions, relies on the precise application of radioactive isotopes within affected joints. Nuclear medicine technologists assume a pivotal role in ensuring the procedure's success through tasks encompassing patient assessment and preparation, radiopharmaceutical handling, injection administration, radiation safety, and patient care. Collaborative efforts with other healthcare professionals, coupled with meticulous record-keeping, further enhance the quality of patient care. The expertise and commitment of nuclear medicine technologists are fundamental in enhancing the well-being of individuals enduring painful joint inflammations.

Novelty

This abstract emphasizes the crucial significance of nuclear medicine technologists in radiosynovectomy, emphasizing their expertise in facilitating successful procedures for individuals with inflammatory joint conditions. Recognizing this importance is essential for healthcare professionals and researchers to acknowledge the pivotal role technologists play in improving patient outcomes.



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THE USE OF DEEP NEURAL NETWORK FOR ESTIMATION OF VOXEL LEVEL INTERNAL DOSIMETRY

SAJID BASHIR - PINUM

Abstract

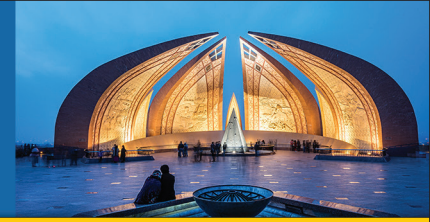
Accurate personalized dosimetry is essential due to the increasing interest in personalized medicine. Although direct Monte Carlo simulation is a state-of-the-art voxel-based dosimetry technique, it has significant computational costs and time requirements. Therefore, to address the limitations of the direct Monte Carlo approach we perform personalized dosimetry through the utilization of deep neural network (DNN), for predicting voxel level doses. This approach takes into account the variations in activity distribution and the unique anatomy of the patient to calculate dose from 3D images. It takes considerably little time to complete the job when compared with Monte Carlo methods. The patch-based DNN architecture employed in this research work is composed of 16 convolutional layers followed by batch normalization, a Leaky rectified function (LReLU) as an activation function, and a $2 \times 2 \times 2$ max pooling layer. The optimization of the DNN was performed based on the L1 loss function (mean absolute error). We used in-house 3D SPECT and CT images as inputs for the DNN. The DNN architecture was trained to generate dose rate maps and compared the results initially with the values in the literature. The errors in predicted dose rates and those in literature were $20\% \pm 3.15\%$. Further work is in progress to determine the patient-specific dose rate maps from the GATE (Geant4 Application for Emission Tomography) Version vGATE 9.3 Monte Carlo simulation, considered as ground truth to minimize the error. For organ-level dosimetry, the average organ doses will be compared with the common dosimetry software OLINDA/EXM. The softwares are currently available in-house. The proposed DNN-based dosimetry method is expected to improve upon existing methods by providing comparable results to direct Monte Carlo simulation with significantly shorter calculation times.

Novelty

Deep learning has emerged as a promising alternative, particularly in dosimetry both in imaging and radiation therapy. It has showcased superior performance compared to traditional state-of-the-art methods. We introduced a patch-based deep neural network (DNN) for fast calculation of dose rate maps and organ doses on in-house SPECT and CT images and compared the performance of this approach to the gold standard.



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THE ROLE OF LUTETIUM IN NEUROENDOCRINE TUMOR TREATMENT : FROM BENCH TO BEDSIDE

AAKIFULLAH - IRNUM

Abstract

Neuroendocrine tumors (NETs) are a diverse group of neoplasms arising from neuroendocrine cells and can occur in various organs throughout the body. The management of NETs has evolved significantly in recent years, with the advent of peptide receptor radionuclide therapy (PRRT) emerging as a promising treatment option. This poster explores the journey of lutetium-177-dotatate, a radionuclide therapy, from bench to bedside in the treatment of neuroendocrine tumors, highlighting its mechanism of action, clinical applications, and future prospects.

Novelty

This poster represents a bridge between bench research and patient care, which is crucial for advancing medical science.



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STANDARDIZATION IN PRE-IMAGING PROTOCOLS IN FOLLOW UP 18FDG PET/CT STUDIES IN LYMPHOMA PATIENTS; REASONS BEYOND BENCHMARK

NOSHEEN FATIM - AKUH

Abstract

Aim: To see compliance of Standardization in pre-imaging protocols of follow up PET/CT studies in treatment response of lymphoma patients and scrutinize the reason(s) of deviation beyond the benchmark. **Materials and Methods:** Study Settings: PET/CT section of Radiology Department, Aga Khan University Hospital, Karachi, Pakistan **Study Design:** Retrospective single-center clinical Audit project. **Study Duration:** Patients' record will be collected retrospectively from June 2021 till December 2022. **Data Collection:** Patient's questionnaire of baseline and interim 18FDG PET/CT studies from 1.6.2021 till 31.12.2022 were retrospectively retrieved.

Results: Study included 52 patients with lymphoma (M:F = 33 :19; Mean Age in Yr = 51 ± 15) who had baseline and interim 18FDG PET/CT studies. No significant difference was found between baseline and interim studies in fasting blood glucose level (109 ± 32 Vs 108 ± 22 , mg%), 18FDG administered dose (175 ± 37 Vs 164 ± 30 , MBq), Uptake Time (67 ± 12 Vs 68 ± 09 , min), Hepatic SUVmean (1.79 ± 0.44 Vs 1.83 ± 0.35) and body mass index in Kg/m². We found good compliance to benchmark for Hepatic SUVmean $\pm 20\%$ and Δ FDG dose $\pm 10\%$. But 10/52 studies had non-compliance in Uptake Time ± 15 minutes (80% Vs 85%). Root-cause-analysis (RCA) found for non-compliance found to be due to release of prior bed bound patients and prolong radiation planning session.

Conclusion: We found good compliance to benchmark derived from EANM 2015 recommendations for fasting glucose, administered 18FDG dose and hepatic SUVmean. However, in 10 studies we found non-compliance in uptake time due to delays caused bed-bound patients and unexpected radiation planning session.

Recommendation:

1. Bed bound patients to be adjusted at the end of the day except urgent/priority cases
2. Radiation planning routinely in early morning before scheduled PET/CT list
3. Unplanned prolong radiation planning to be adjusted in end of schedule list.

Novelty

18FDG PET/CT plays an important role by helping the oncologists and guides them whether to continue, change or abandon a treatment, depending upon the response of the tumor. Treatment responses are often measured by use of percentage changes in SUVs (standardized uptake value) in a patient across all longitudinal studies of that patient. The standardization is needed for the use of quantitative 18FDG PET/CT as an imaging biomarker. The execution of standardization of 18FDG PET/CT study refers to all steps involved in obtaining quantitative uptake measures (including preparation of a patient, PET/CT acquisition, image reconstruction, data analysis, and PET/CT system calibration procedures).



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ARTIFICIAL INTELLIGENCE ASSISTED DIAGNOSIS OF METASTASIS ON WHOLE BODY BONE SCAN IMAGES

ZEESHAN HAMEED¹ - NUST

Kamran Aziz Bhatti¹, Dr Shahzad Amin Sheikh¹, Dr. Kahkashan Mir², Dr Ayesha Ammar², Dr Shazia Fatima², Dr. Ambreen Khawar³

1. Department of Electrical Engineering, EME, National University of Science and Technology, Islamabad, Pakistan
2. Atomic Energy Cancer Hospital, Nuclear Medicine Oncology & Radiotherapy Institute (AECHNO RI), Islamabad, Pakistan
3. Department of Medical Sciences, Pakistan Institute of Engineering and Applied Sciences, Islamabad, Pakistan

ABSTRACT

Decision making perception knowledge and planning are the fundamental prerequisites of tumor detection through artificial intelligence. To achieve these objectives, AI techniques/ Algorithms like DICOM conversion, mask RCNN and binary classifier are used. In this study we have used these techniques to classify metastatic from normal uptake on bone scans.

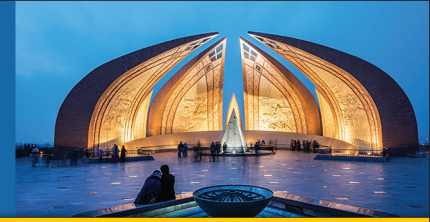
Method: BS 80K data of 3247 patients; 1024 Males (mean age of 59.03 ± 15.15) and 2023 Female (mean age 53.55 ± 13.06) was used for the study. The images were obtained in the form of DICOM files which had patient information as well as anterior and posterior whole body bone scans. First the scans were converted to jpeg format of 24 bit using OpenCV. Then Mask RCCN was used to extract body regions from bone scan with target (metastatic) areas like skull, vertebra, chest and pelvis. All body regions were assigned its own model file. When new scan was put in the Mask RCCN algorithm then model files were used for comparison, extraction and saving in the respective region folder. The images were then subjected to binary classification. The classifier was self-made classifier for the classification of body regions. As the bone scans were found to be of different dimensions due to different body habitus of the patients, the binary classifier model was first trained for different dimension of images. Finally for each body region, model was trained for classification of two classes i.e., normal and diseased (metastatic) uptake on bone scan.

Conclusion: In this pilot study we have found these Algorithms successful for classification of metastatic uptake on bone scans.

Keyword: Mask region based convolution neural network (Mask RCNN)



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ABSTRACT (Posters)



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AN UNSUSUAL CASE OF ALVEOLAR RHABDOMYOSARCOMA OF NASAL SINUSES WITH ORBITAL INVOLVEMENT IN AN ADULT PATIENT

AZRA PARVEEN - INMOL

Abstract

Rhabdomyosarcoma is an uncommon soft tissue malignancy that is typically found in pediatric group. Here we describe a case of metastatic alveolar rhabdomyosarcoma of paranasal sinuses in an adult woman who presented with several months of unilateral sinus symptoms that was initially misdiagnosed as sinusitis. She didn't respond to the antibiotics treatment and her nasal endoscopy after 3 months revealed right nasal cavity mass and histopathology was consistent with alveolar rhabdomyosarcoma. Her imaging test, including CT, MRI and PET/CT revealed neoplastic mass, centered at left ethmoidal sinus and extending into the left frontal & maxillary sinuses, involving left orbital cavity, along with cervical nodal involvement.

This case of sinonasal rhabdomyosarcoma is unique in its occurrence in adult age group and its extension and orbital involvement at time of diagnosis. This it highlights the importance of maintaining a high index of suspicion of malignancy in patients with unilateral sinus symptoms.



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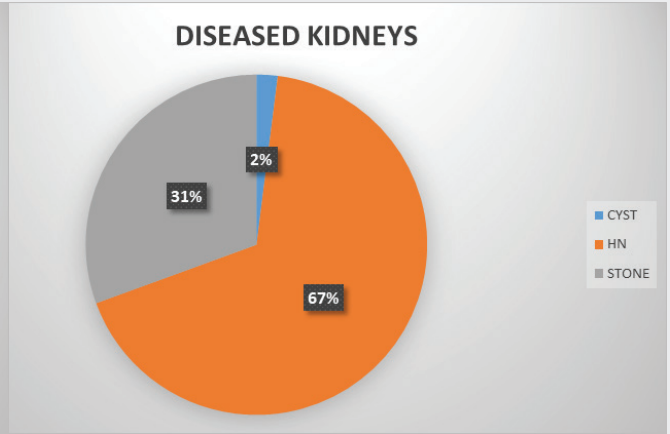
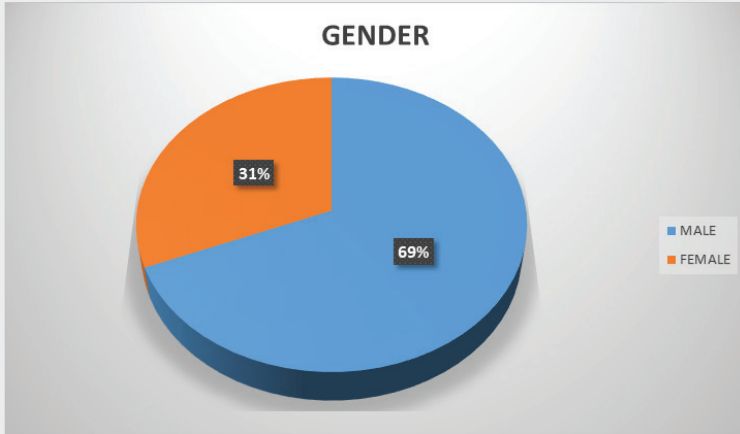
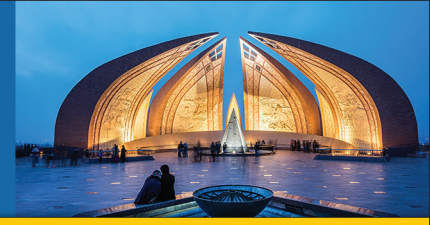


ABSTRACT

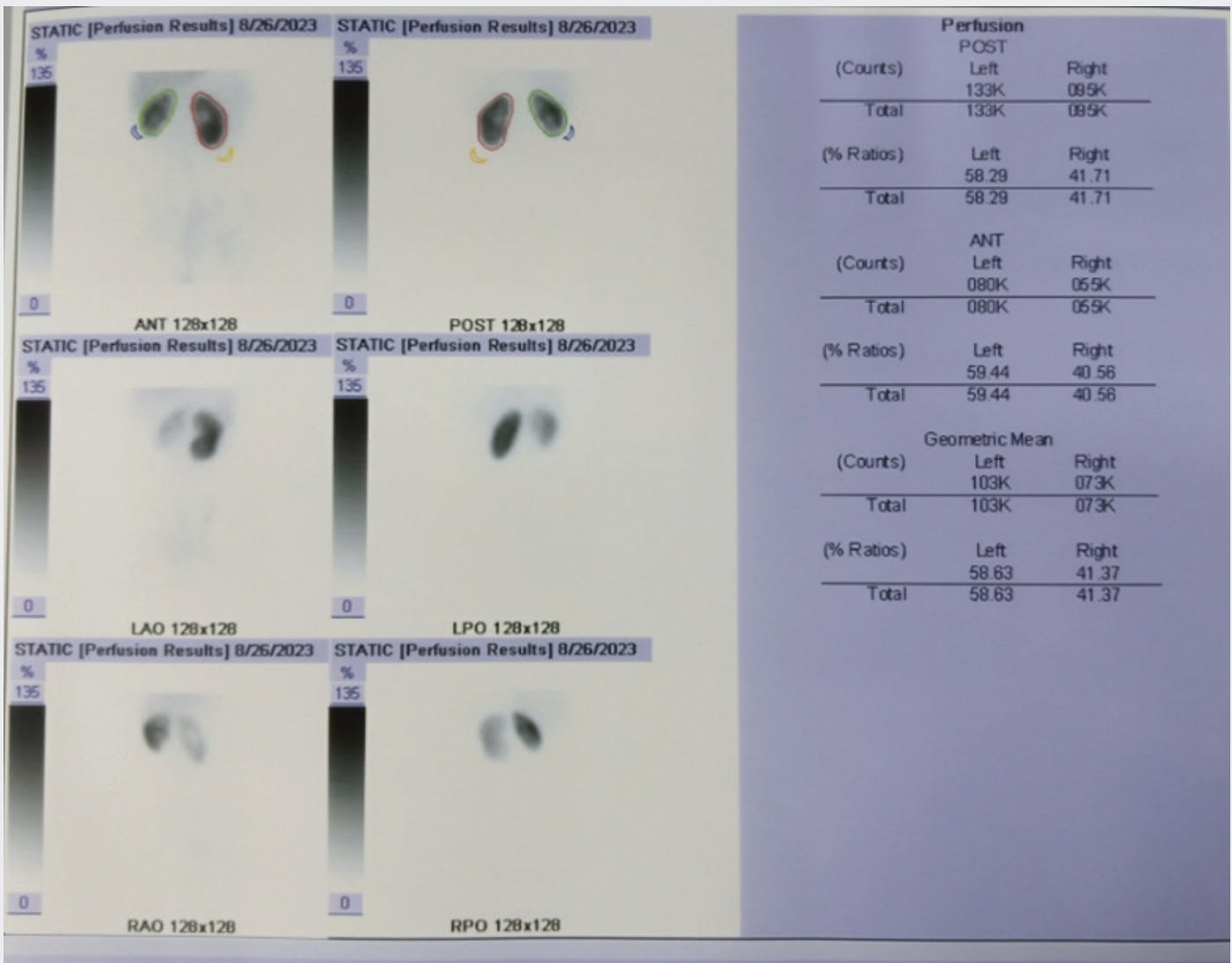
TAHIRA YASMEEN - INMOL

⁶⁸Ga PSMA PET-CT scan is the most evolving imaging modality in the management of carcinoma prostate (PCa). On account of improved sensitivity and specificity it is utilized for the staging and biochemical recurrence of PCa. Aim of study was to compare the diagnostic performance of ⁶⁸Ga PSMA PET-CT and pelvic mpMRI in detection of prostate carcinoma. Methods: 25 patients with PCa were enrolled in this study for staging work up, PSMA scan and mpMRI were performed and findings of both studies were compared. Patient and lesions based analysis was done. Pearson's correlation was applied to assess correlation between variables (PSA, PSMA Score, PI-RADS). Results: 21/25 patients were identified as disease positive on PSMA PET-CT whereas mpMRI detected local/ metastatic pelvic disease in 23 cases. Total 29 lesions were detected by ⁶⁸Ga PSMA PET-CT scan; break down includes 19 lesions confined to prostatic fossa, 06 pelvic nodal, 03 metastatic and 01 visceral lesion. mpMRI pelvis detected 27 lesions including 21 in prostatic fossa (11 intra-capsular and 10 extra-capsular), 04 pelvic nodes and 02 pelvic osseous lesions. A weak positive correlation was established between PSMA score and PI-RADS.

Conclusion: 1. ⁶⁸Ga PSMA PET has superior specificity for the assessment of local lymph node metastases and osseous involvement. 2. mpMRI appears to be the preferred modality for determining intra-prostatic, extra-prostatic, seminal vesicle and bladder involvement. 3. Both modalities should be used in conjunction with each other for early, improved diagnosis and better treatment planning.



PROCESSING ON SYNGO-P SOFTWARE OF PATIENT A





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ABSTRACT

Diagnostic accuracy of ultrasound based thyroid imaging reporting & data system (TIRADS) in detecting benign & malignant thyroid nodule considering FNAC as a gold standard.

BUSHRA SABEEN - KIRAN

Dr. Javaid Mehboob, Dr. Adnan Hashmi, Dr. Quratul Ain, Dr. Shazia Fatima
Karachi Institute of Radiotherapy and Nuclear Medicine (KIRAN)

BACKGROUND: Occurrence of thyroid nodule is common and its detection depends on different method. The accurate method by which thyroid nodule is detected is ultrasonography (67%). Ultrasound not only diagnosed thyroid nodule but it is also helpful to stratify the disease by differentiating it as benign versus malignant. The most popular risk stratifying system is TIRADS (thyroid imaging reporting & data system) using ultrasound features of nodules. **OBJECTIVES:** This is a prospective cross section study that was conducted in department of Radiology KIRAN Hospital over a period of six months from September 2022 to February 2023 in total 50 patients. Inclusion criteria: 1) Neck swelling found on palpation and suspected for thyroid nodule / detection of thyroid nodule by ultrasound 2) Patient referred from nuclear medicine department for further workup of cold nodule on thyroid scan 3) Size of nodule greater than 2.5 cm. Exclusion criteria: 1) Patient with neck swelling who had normal thyroid 2) Patient who refused for FNAC 3) Subject with history of bleeding diathesis. **MATERIAL & METHOD:** Ultrasound of thyroid was done on GE logic S8 (XD clear) machine using linear transducer of 5- 15-Hz All the nodule were assessed using ultrasound features given in ACR - TIRADS classification (i.e.: composition, echogenicity, shape, margin, echogenic foci) . Score was assigned for features noted in each category accordingly. All Scores were summed up and then used to classify nodules from TR1-TR5. Additional information regarding patient age, gender, nodule location, size and numbers were also collected. Each nodule further underwent ultrasound guided FNAC to establish pathological diagnosis. **RESULT:** In our study we found total 60 thyroid nodules; out of which 12% (7/60) fall in group TR-1, 12/60 (20%) in group TR-2, 2/60 (3%) group TR-3, 18/60 (30%) group TR-4, 21/60 (35%) in group TR-5. All these patients underwent FNAC after taken informed consent. According to FNAC; out of 60 thyroid nodule 30% (18/60) were found to be benign, 5% (3/60) showed atypia, 3% (2/60) showed inadequate sampling and 62% (37/60) were found malignant. **DISCUSSION:** The average patient age in study population was 45 years. Out of 60 patients 40 were female (66.6%) & 20 were male (33.3%), hence female gender predominance was noted. Right lobe of thyroid gland was noted as the most common location for existence of nodule. Majority of the nodule in our study were solid in composition followed by solid-cum cystic and spongiform nodule. Considering echogenicity, most of the nodules were found to be hypo-echoic followed by isoechoic and hyperechoic. Most of the nodule showed taller than wider in appearance (shape). Some of them appeared wider than taller. Most of the nodule had smooth margin followed by irregular margin & ill define margin. Half of nodules had macro-calcification & punctate echogenic foci. Some of them had no echogenic foci. According to our study, the incidence of malignancy was found to be highest in those nodules which were solid, hypoechoic, taller than wider, irregular margin and had punctate echogenic foci. **CONCLUSION:** It is concluded from our study that TIRADS is an accurate scoring system in classifying benign nodules from malignant nodules and by the application of TIRAD, rate of FNAC procedure for benign nodule can be reduced.

References:

1. TI-RADS classification of thyroid nodules based on a score modified according to ultrasound criteria for malignancy: J. Fernández Sánchez; Rev. Argent. Radiol. 2014; 78(3): 138-148.
2. Thyroid nodule ultrasound accuracy in predicting thyroid malignancy based on TIRADS system: Wanlu Nie, Lili Zhu, Ping Yan, Jie Sun; Adv Clin Exp Med. 2022;31(6):597-606 599.



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DIAGNOSTIC CHALLENGE: ACHALASIA MASQUERADING AS RETROSTERNAL GOITER ON THYROID SCINTIGRAPHY; A CASE REPORT

HAFSA ARSHAD - MINAR

Abstract

The case report discusses the diagnosis of a 20-year-old female who presented with symptoms of multinodular goiter, palpitations, and dysphagia. Thyroid scintigraphy was performed, and although it showed signs of multinodular goiter, there was an unexpected finding of increased radiotracer accumulation extending beyond the supraclavicular notch, which was in continuity with the thyroid gland. SPECT/CT imaging was then carried out, revealing a dilated esophagus with pooling of pertechnetate avid radio-labelled saliva and characteristic bird beak deformity involving the distal end of the esophagus.

Further workup revealed the diagnosis of achalasia, which is a relatively common esophageal motility disorder characterized by dysphagia, regurgitation, and heartburn. The condition is usually diagnosed through conventional radiographic barium swallow and manometry test. However, in patients undergoing thyroid scintigraphy, the retention of radio-labelled saliva in the dilated esophagus may mimic retrosternal goiter.

Therefore, the addition of hybrid SPECT/CT imaging technique to the protocol resulted in a significant increase in specificity of thyroid scintigraphy. The SPECT/CT scan localized the activity to the dilated esophagus, which helped in the accurate diagnosis of achalasia. This case report highlights the importance of SPECT/CT imaging in enhancing the specificity of thyroid scintigraphy for the evaluation of retrosternal goiter in patients with suspected esophageal dysmotility disorder.

Novelty

This case report highlights the importance of using hybrid imaging techniques, such as SPECT/CT, for the accurate evaluation of any pathology like retrosternal goiter in this case. The addition of SPECT/CT imaging technique to the protocol resulted in increased specificity by localizing the activity to the dilated esophagus, ruling out the possibility of retrosternal goiter. These findings emphasize the importance of utilizing SPECT/CT to avoid false-positive results and ensure accurate diagnosis and thus appropriate treatment.



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FORMULATION, RADIOBIOLOGICAL EVALUATION, QC AND CLINICAL APPLICATIONS OF LU177 HYDROXY APATITE INTENDED FOR RADIOSYNOVECTOMY.

SAILEEN KHAN - IRNUM

Abstract

Background:

The emerging Lutetium-177 (^{177}Lu) has opened new arenas in the field of theranostic Nuclear Medicine. The therapeutic potentials of ^{177}Lu can be well explored by labeling it with Hydroxy Apatite. Dependence of the radio labeling yields on incubation time, temperature, pH and centrifugation was examined.

Aims:

The aim of this study was to formulate and evaluate ^{177}Lu HA for radiosynoviorthesis applications.

Material and Method:

HA suspension was labeled with ^{177}Lu in basic media under aseptic conditions. Radiochemical purity of the labeled product was carried out by paper Chromatography techniques. The stability of ^{177}Lu HA was observed at room temperature for 24 hrs in saline, in blood serum and synovial fluid for up to 48hrs. The radiopharmaceutical was then injected into the knee joints of patients. The biodistribution images were acquired at 1hr, 24hrs and 48hrs post injection using GE NM/CT Gamma Camera.

Results:

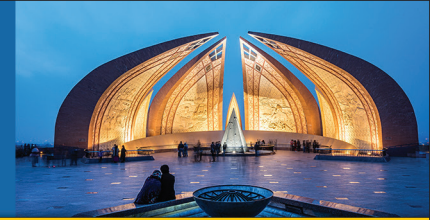
The labeling efficiency of ^{177}Lu HA was $96.5 \pm 0.5\%$ at the conditions of HA 7.5mg, 0.1ml of 0.5M NaHCO_3 , ascorbic acid 10mg at pH 8.5. After centrifugation, the radiochemical purity (RCP) was $98.95 \pm 0.5\%$. The biodistribution images showed no leakage of the tracer into the surrounding tissues or regional lymph node.

Conclusion:

Higher labeling efficiency, long time stability and simple procedure make ^{177}Lu HA, a suitable candidate for the treatment of chronic inflammatory, Hemophilia and other intra-cavitary therapy applicatio



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UTILITY OF Tc-99m UBI (29-41) SPECT/CT FOR DIAGNOSIS AND FOLLOW UP OF SKULL BASE OSTEOMYELITIS – COMPARISON WITH Tc-99m MDP SPECT/CT

IMRAN ASIF - CEAR

ABSTRACT

Introduction:

Tc-99m Ubiquicidin (29–41) is a cationic, synthetic antimicrobial peptide fragment that binds preferentially with the anionic microbial cell membrane at the site of infection. Skull Base Osteomyelitis (SBO) is a life threatening infection which requires early and accurate diagnosis.

Aims and Objectives:

To evaluate the utility of Tc-99m UBI Single-Photon Emission Computed Tomography/Computed Tomography in the diagnosis and monitoring treatment response of Skull Base Osteomyelitis (SBO).

Methods:

32 patients with clinical suspicion of skull base osteomyelitis were included in the study. Out of these 32 patients 20 were males (62.5%) and 12 were females (37.5%) with mean age of 51.5 ± 9.1 years and range between 22-80 years. Post treatment response was studied in 15 patients of SBO. Each patient underwent Tc-99m MDP bone SPECT/CT and Tc-99m UBI (29–41) SPECT/CT. Tc-99m UBI (29-41) was injected in a dose of 11mCi. SPECT/CT of the skull was obtained after 30 mins followed by whole body scan. Both the scans were interpreted as True Positive, False Positive, True Negative & False Negative based on culture, histopathology and clinical data.

Results:

In case of Tc-99m UBI (29–41), true positive cases were 23, true negative were 8, false positive were 0 and false negative were 01 with 100 % specificity, 95.8% sensitivity, PPV of 100%, NPV of 88.8 % with a diagnostic accuracy of 96.8%. While Tc-99m MDP bone scan showed sensitivity of 100%, specificity of 62.5 %, PPV of 88.8%, NPV 100% and diagnostic accuracy of 90.6%. Treatment response was monitored through scan findings of Tc99m UBI (29-41) SPECT/CT and Tc-99m MDP SPECT/CT in 15 patients after antibiotic therapy. 7 patients showed complete response, 5 patients showed partial response (including one patient who also received surgical treatment) while 3 patients showed no response to treatment.

Conclusions:

The study showed that radiolabeled antimicrobial peptide, Tc-99m Ubiquicidin (29-41) is a specific imaging agent and shows promising results in the localization of skull base osteomyelitis. Moreover, it can also be used to monitor treatment response of skull base osteomyelitis.



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INITIAL EXPERIENCE WITH LOCALLY PRODUCED LU-177 DOTATATE FOR TREATMENT OF GASTRO- ENTEROPANCREATIC NEUROENDOCRINE TUMORS (GEPNETS) AT IRNUM

SABIN ZIA

Aakif Ullah khan, Hameedullah, Irfan Ullah, Saileen Khan, Imran Khan
Email: sabinzia@gmail.com

Neuroendocrine tumors are relatively rare and typically slow-growing neoplasms. Lu-177 Dotatate therapy is a form of endo-radiotherapy that serves as an effective therapy for patients with inoperable, locally advanced or metastatic, gastroenteropancreatic neuroendocrine tumors, which progress on conventional treatment.

Improvements in

- disease control rates
- progression free survival
- overall survival and
- quality of life, has advanced this radiopharmaceutical agent to a place of primary consideration in advanced disease management.

The recent initiative for the production of Lu-177 Dotatate in Pakistan during last 9 – 10 months has made it possible for us to share our initial experience with indigenously produced lu-177 Dotatate. For therapy a recommended dose of 800 mCi Lu-177 Dotatate is given in 4 cycles of 200 mCi each. At the moment we have 5 patients at various stages of their treatment and 2 of these have completed 4 cycles.

Each patient underwent a pre-therapy scan with ^{99m}Tc Hynic Tate & baseline investigations. For therapy 2 IV lines were placed in both arms, one for Lu-177 Dotatate injection and other for reno-protective amino acid infusion.

Whole body images were acquired at 1 hour, 4 hours, 24 hours and 48 hours. SPECT CT images were acquired at 4 hours post injection. Patients were discharged 6 hours after Lu-177 Dotatate injection.

We would like to tell you about 2 of our patients who have received 4 cycles of 200 mCi each Lu-177 Dotatate.

Patient A, 54 year M, presented with a low-grade, large multifocal inoperable tumor arising from small intestine, having secondaries in liver, and invading the right kidney and his disease was progressing on conventional treatments. Bilirubin was 19 mg/dl and ECOG was 4. Lu-177 Dotatate 200 mCi was given after high-risk consent. At 4 weeks, Bilirubin was reduced to 2.5 mg/dl. At 8 weeks, Bilirubin was 1.3 mg/dl and ECOG 3. At the time of 4th cycle, his ECOG was 1 and bilirubin was 0.4 mg/dl. The patient had a significant clinical response, despite the fact that imaging showed minimal reduction in tumor sizes. His last dose was in May 2023 and as of today, he is doing well 6 months later.

Patient B 70 year F, presented with pain abdomen, a very large Grade I multifocal inoperable tumor involving liver and abdominal lymph nodes, she was not responding well to somatostatin analogs, ECOG 3. Lu-177 Dotatate 4 cycles x 200 mCi each were given. At the time of 4th cycle, she was happy that her diarrhea had improved, and she was able to sleep comfortably at night without pain, ECOG 1. Despite a satisfactory clinical response, her tumor showed minimal reduction in size.

To conclude, both of these patients had a good clinical response and improved quality of life. And as the literature shows a satisfactory outcome in such patients, we are also hoping for favorable outcomes of adequate disease control and long progression-free survival.



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CORRELATION OF DUKE'S TREADMILL SCORE WITH GATED MYOCARDIAL PERFUSION IMAGING AND CT ANGIOGRAPHY IN PATIENTS REFERRED FOR CHEST PAIN EVALUATION

M SADIQ - CENAR

ABSTRACT

Introduction:

The coronary artery disease is caused by atherosclerosis which is a buildup of fatty material along the inner walls of the arteries. In CAD, the flow of blood is reduced to the heart muscle due to plaque in the arteries of the heart. A common symptom is chest pain or discomfort usually travels into the shoulder, arm, back, neck or jaw.

Aim and objective:

To correlate the Duke's treadmill score (DTS) with Gated myocardial perfusion imaging and CT angiography in patients referred for chest pain evaluation.

Materials and methods:

It was randomized cross-sectional study conducted at Nuclear Medical Center (NMC), Armed forces institute of pathology (AFIP), Rawalpindi from 12th November 2018 to 24th May 2019. A total of 42 patients were enrolled. Out of these, 32 were males and 10 were females. The patient's age ranges from 36 to 77 years. All patients were eligible for Exercise tolerance test (ETT) according to Bruce's protocol. After that, DTS was calculated and gated myocardial perfusion imaging was done and summed stress score was calculated. Data was analyzed using commercially available statistical package for social sciences (SPSS version 16) and spearman's rho ranking was applied.

Results and discussion:

Out of 18 patients of low risk DTS, 16 have SVCAD and 2 have DVCAD on CTA. 11 have no ischemia, 1 has mild ischemia, 4 have moderate ischemia and 2 have severe ischemia on gated myocardial perfusion imaging. Out of 24 patients of moderate risk DTS, 10 have SVCAD on CTA, 10 have DVCAD and 4 have TVCAD. 14 have no ischemia on MPI, 4 have mild ischemia, 2 have moderate ischemia and 4 have severe ischemia. Spearman's ranking showed 0.489 for CTA and 0.013 for MPI.

Conclusion:

Good correlation of DTS with CT angiography whereas weak correlation of DTS with GMPI were observed.



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NUTCRACKER SYNDROME

NAYAB MUSTANSAR - AFIRI - MH

Abstract

A 30 years old male, resident of Rwp reported at PEMH RWP (March 2023) with complains of left flank pain and single episode of macroscopic haematuria. He was referred to AFIRI for further imaging work up. His BCP showed anemia and Urine R/E showed microscopic haematuria. His USG KUB was done which came out to be normal. His CT plain was done which showed compression of the left renal vein (LRV) between the superior mesenteric artery (SMA) and the abdominal aorta moreover it revealed that the ratio between the renal hilum and the aortomesenteric left renal vein was 2.7 and a diagnosis of nutcracker syndrome was made. His PET-CT was performed and the PET image indicated abnormal radioactivity levels in the left kidney. He was managed conservatively (young patient with no complications). Although surgery is the mainstay of treatment.

Nutcracker syndrome is a rare clinical entity caused by compression of the left renal vein (LRV) between the superior mesenteric artery (SMA) and the abdominal aorta (anterior nutcracker syndrome), another type is posterior nutcracker syndrome in which a retroaortic left renal vein is compressed between aorta and vertebrae. If asymptomatic and uncomplicated, they are usually managed conservatively. Cases with symptoms or complications, appropriate surgical intervention should be considered.

Novelty

1. It is a rare clinical entity caused by compression of the left renal vein (LRV) between the superior mesenteric artery (SMA) and the abdominal aorta (anterior nutcracker syndrome). It is usually an incidental finding in most PET-CT scans. 2. The role of PET-CT in the diagnosis of nutcracker syndrome is still under-rated although a lot of innovative work is being carried out for its significance specially in patients with other primary cancers where it is incidentally diagnosed on PET-CT during the work up.



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PHOTODYNAMIC THERAPY IN LESHMENIASIS USING INDIGENOUSLY PRODUCED PHOTSENSITIZER AND LASER MACHINE

QAMAR ZIA - IRNUM

Abstract

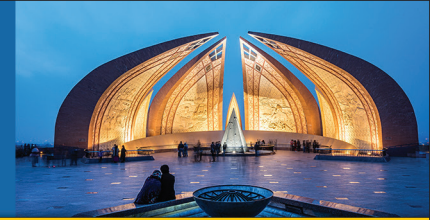
Photodynamic therapy (PDT) has emerged as a promising treatment for Cutaneous Leishmaniasis, offering an indigenous solution to the challenges posed by sourcing external Photo Sensitizers and Laser machines. This poster highlights the indigenization efforts undertaken at PINSTEC by scientists and engineers of PAEC, focusing on the successful production of 5ALA Photo Sensitizer and Laser machines. Additionally, we present a case study showcasing the significant improvements observed in two young patients who underwent PDT, marking a remarkable advancement in the fight against Cutaneous Leishmaniasis.

Novelty

Photodynamic therapy in Leshmeniasis Using indigiously produced Photosensitizer and Laser Machine



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PROGNOSTIC STRENGTH OF CA-19-9, DEMOGRAPHIC PARAMETERS AND SUVMAX OF BASELINE 18FDG PET/CT IN TREATMENT NAÏVE PATIENTS WITH PANCREATIC CARCINOMA

NOSHEEN FATIMA - AKUH

Abstract

Aim/Introduction: The aim of this study was to evaluate prognostic value of imaging based variables and tumor marker in predicting the progression free survival in treatment naïve pancreatic cancer (PC) using baseline 18FDG PET/CT.

Materials and Methods: This retro-prospective study was conducted at PET/CT Imaging facility of JCIA healthcare facility of Pakistan. Total 68 patients with PCs were retrospectively included who had 18FDG PET/CT for staging from March 2017 till December 2020. Thirty-two patients had unresectable stage IV disease on baseline imaging while remaining 36 underwent Whipple's procedure and both categories were followed by chemotherapy with/without immunotherapy. These patients were followed for a median period of 18 months (1 - 62 months) for progression free survival (PFS). Logistic regression analysis and receiver operating characteristics (ROC) analysis were used for independent predictors of patients' demographics, tumor characteristics, CA-19-9 and maximum standardized uptake value (SUVmax) in PFS. Kaplan Meier's survival curves were analyzed to measure PFS using ROC derived significant cutoff values of CA 19-9 and SUVmax.

Results: Median PFS was 18 months (11-45) with 60% (41/68) patients were either died or labelled metabolic progressive disease (MPD) on followup. Using logistic regression analysis significant correlations were found for stage IV disease and pancreatic body/tail tumor with disease progression (Odd ratio; 7.535 and 4.803 respectively; $p < 0.05$). Gender, obesity, histological tumor type and 18FDG avid regional nodes did not show significant impact on PFS. On ROC analysis; SUVmax > 5.3 of primary tumor and baseline CA 19-9 > 197 U/ml were found to have significant negative correlation with PFS (AUC 0.827 and 0.911 respectively; $p < 0.0001$) and no association of age and primary tumor size (PTS) in PFS. Significantly shorter PFS were found using ROC derived cutoff values of SUVmax > 5.3 versus ≤ 5.3 of primary tumor (mean and 95%CI; 16.7 vs. 48.5 and 10-23 vs 41-56; logrank=25.014; $p < 0.0001$) and baseline CA19-9 > 197 versus ≤ 197 U/ml (mean and 95%CI; 11.8 vs. 46.9 and 7-16 vs 39-55; logrank=38.217; $p < 0.0001$).

Conclusion: SUVmax > 5.3 of primary tumor and baseline CA 19-9 > 197 U/ml were found to have significant negative correlation with PFS in treatment naïve PC patients. Among demographics, only stage IV disease and pancreatic tail and body tumors were found to have negative association with disease progression.

Novelty

Prognostic significance of standardized maximum uptake value (SUVmax) of pancreatic cancer and serum carbohydrate antigen (CA)19-9 well studied in many published literature internationally but not addressed in local population.



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ROLE OF RADIOSYNOVIORTHESIS IN HEMOPHILIA – IRNUM EXPERIENCE WITH LU-177 HA

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Radiosynoviorthesis is an old technique that has been in clinical use for more than half a century. The term Radiosynoviorthesis was first introduced in 1968 by Delebarre.

Radiosynoviorthesis is the reconstruction / renewal of the inflamed synovial membrane with the use of intraarticular injection of beta-particle emitting radiocolloids. In this process, the diseased synovium is destroyed and replaced by healthy synovium.

One of the most important indications of Radiosynoviorthesis is Hemarthrosis or bleeding into the joint in hemophiliac patients. The synovial tissue in hemophiliac patients is highly vascularized and even minor trauma can lead to bleeding into the joint.

Repeated episodes of Hemarthrosis, iron overload into the joint, inflammation of the synovium, and neoangiogenesis lead to joint remodeling and subsequent hemophilic arthropathy.

Hemophilic arthropathy primarily affects the large synovial joints, especially the knee, ankle, and elbow joints.

Treatment options include:

1. Chemical synovectomy: Rifampicin, intraarticular glucocorticoid injections etc.
2. Surgical synovectomy: Time-consuming and has a long recovery period. Sometimes the diseased tissue cannot be fully removed.
3. Radiosynoviorthesis: Y-90, Re-186, Lu-177 HA

We would like to share our experience with the use of Lu-177 HA at IRNUM. So far we have treated 9 patients and 6 had Hemarthrosis.

Lu-177 HA, Half-life 6.7 days, $E\beta$ max 0.5 MeV, 1.7 mm to 2 mm $E\gamma$ = 208 keV, 113 keV.

When a radiocolloid is injected, it is phagocytized by the macrophages in the lining of the inflamed synovial membrane, resulting in fibrosis and sclerosis of the diseased synovium and finally, there is reduced swelling and pain in the joint.

In hemophilia, if there are 2 – 3 bleeds / 6 months despite intensified factor therapy or there are inhibitors to factors 8 or 9 then Radiosynoviorthesis should be considered. Studies have shown that some patients had complete cessation of bleeding in the joints following Radiosynoviorthesis.

This treatment is most helpful earlier in the course of hemophilic arthropathy, however, it is effective even in patients with moderate arthropathy where surgery has not been considered yet.

Studies have also shown that 70 to 90% of patients benefit from Radiosynoviorthesis concerning bleeding frequency, the intensity of pain, joint function, and thickness of the synovium.



SCINTIGRAPHIC PATTERNS OF DUPLEX KIDNEY WITH COEXISTING RENAL ANOMALIES

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ORIGINAL ARTICLE

Background: ^{99m}Tc -Dimercaptosuccinic acid (DMSA) scan is study choice to estimate relative function and is useful to confirm renal congenital anomalies, agenesis, multicystic kidney disease or renal hypoplasia/dysplasia as it produces excellent high-resolution images of the renal cortex. Duplex renal collecting systems are one of the most common congenital anomalies of the urinary tract comprised of two pelvicalyceal systems with many variations within this condition. However, in some individuals there are other associated congenital and acquired urinary tract conditions and coexistence of these abnormalities are not frequently found. It is recommended to evaluate the presence of scarring in the kidney and detailed upper-lower pole renal function with DMSA scintigraphy. The patterns of duplex kidneys with coexisting anomalies on DMSA renal cortical scans and correlating findings on other imaging modalities are presented in this case series.

Case #1: 25-year-old female presented with severe dysuria. Her initial computed tomography (CT) urogram, revealed a small sized ectopic (pelvic) kidney with partial duplex collecting system and malrotated pelvis (Figs A1). Renal cortical scintigraphy revealed right pelvis kidney with reduced uptake in the upper moiety with a split differential function of 31%(Fig A2).

Case #2: Eight-year-old boy presented with left sided abdominal pain and distention. His initial computed tomography (CT) urogram revealed a horseshoe kidney, complete duplication of the left collecting system, marked hydronephrosis of the left upper moiety with severe parenchymal atrophy, and ureterocele (Fig B1). Renal cortical scintigraphy revealed horseshoe kidney with non-functioning band and decreased uptake in the left upper moiety with a split differential function of <10%(Fig B2).

Case #3: Thirteen-year-old boy with imperforated anus and sacral agenesis and history of colostomy, presented with urinary incontinence and constipation. His abdominal MRI revealed right malpositioned kidney and duplication of the left collecting system with hydronephrosis of the right kidney and left upper moiety with severe parenchymal atrophy (Figs C1). Renal cortical scintigraphy revealed decreased uptake in fused right kidney and left upper moiety with a split differential function of <10%(Fig C2.)

Conclusion:

This case series has shown that abnormal anatomic variations usually lead to diagnostic challenges. Diagnosis of duplex kidney on a DMSA scan requires a careful systematic review of the images. Correlation with clinical history and other imaging modalities can be complementary for effective patient management.

Keywords Duplex Kidney. DMSA. Congenital anomalies.



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TC-99M MDP SPECT/CT BONE SCINCTIGRAPHY IN THE DIAGNOSIS OF UNILATERAL CONDYLAR HYPERPLASIA

SHAGUFTA KANWAL - CENAR

ABSTRACT

Introduction: Condylar hyperplasia (CH) is a pathologic overgrowth of one or both mandibular condyles that can disrupt the mandible's neck, ramus, and body. Planar bone scintigraphy and single photon emission computed tomography (SPECT) employing ^{99m}Tc methylene-diphosphonate (MDP) provides a quick way to compare the activity differences between normal and pathological condyles, which indicates the relative growth rates at the time of the examination.

Aims and objectives: The aim of this study was to assess the condylar growth by ^{99m}Tc-MDP bone scan, through quantitative analysis of planar and SPECT images and compared the results with age matched control groups. The study determined the correlation between the age and condylar uptake in normal subjects and mandibular deviation in active and inactive cases of Condylar Hyperplasia (CH).

Material and Methods: 57 patients were enrolled, 26/57 belong to diseased group having CH (14 males and 12 females) and 31/57 belong to control group (15 males and 16 females). All underwent ^{99m}Tc-MDP bone scan with SPECT-CT of head region. The condyle to L4 vertebra ratio on planar and condyle to clivus ratio on summed SPECT images were measured. The percentage difference of condylar ratios $\geq 10\%$, with sclerosis and ground glassy haziness in enlarged condyle on CT were classified as active CH. The mandibular deviation was measured in diseased group on the coronal view of 3D reconstruction image of the head.

Results: Both SPECT and planar parameters classified 17/26 patients as active CH. The mean condyle to clivus ratio (1.026 ± 0.36) and condyle to L4 vertebra ratio (0.665 ± 0.39) of active condyles is higher than control group, i.e, 0.797 ± 0.22 and 0.369 ± 0.19 respectively, ($p = < 0.005$). The mean condyle to L4 ratio and condyle to clivus ratio showed moderate negative correlation with age ($r = -0.522$, $p < 0.05$ and $r = -0.570$, $p < 0.05$ respectively). No statistically significant difference was found for the amount of mandibular deviation among the active ($20.562 \pm 15.02\text{mm}$) and inactive cases (18.261 ± 9.040).

Conclusion: Both planar and SPECT images showed comparable results with higher mean condylar ratios in active cases compared to age matched control groups. The condylar ratios in control group, decreases with increasing age and significantly different among age decade groups. The amount of mandibular deviation is not predictive of active or inactive cases of CH



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UTILITY OF BONE SCAN QUANTITATIVE PARAMETERS FOR THE EVALUATION OF PROSTATE CANCER PATIENTS

Dr. Nayab Mustansar

ABSTRACT

Prostate Cancer is one of the common cancers in the world. It could primarily disseminate to the bone and can lead to death. In order to address its life threatening distant metastasis it is important to diagnose it earlier for timely treatment. Bone metastasis is usually diagnosed deploying bone scan imaging. However interpretation of the bone scans is a tedious procedure for the physicians and often leads to misinterpretation either as overestimation or underestimation of the metastasis.

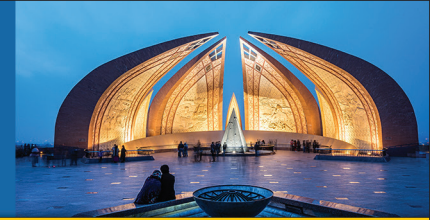
To minimize the risk of misinterpretation, one of the accurate methods is quantitative analysis of the bone scans in order to ascertain, whether a metastatic lesion is present or not. There are several methods to-date which can be used to analyse the extent of such lesions. For example, quantitation of the bone scan using quantitation methods i-e % BSI (Bone scan index), % PAB (Positive area on bone scans), EOD (extent of disease) and BLS (Bone lesion scoring). These methods are used for prognostication of survival and response to treatment on serial scans.

The extent of fidelity of these all available quantitation methods is not clear when used altogether in a single baseline bone scan. Therefore, the aim of this study is to use all available bone scan quantitative parameters on a baseline bone scans and to compare them all. Moreover, an improved methodology is introduced by comparing the results with the individual methods reported in literature and with PSA levels.

141 patients with histopathologically proved prostate cancer were chosen to implement all the four quantitative parameters on individual baseline bone scans. After which, for the calculation of risk of progression or regression of disease and survival rate, 40 patients were chosen from the same dataset.

A serial follow up scan was performed to calculate 2-years survival rate. The dataset was again analysed using the same four bone scan quantitative parameters and the cut off were calculated as % BSI: 1, % PAB: 0.5, EOD: grade 0 & 1, grade 2, 3 & 4 and BLS: 5.

It was found out that the %PAB and % BSI methods are good prognostic indicator in baseline scans. Moreover the prostate cancer patients with the cut off % BSI >1, %PAB > 0.5, BLS >5 and EOD with grade 2, 3 & 4 showed increase risk of disease progression and less survival.



IMPROVING NUCLEAR MEDICINE PROCEDURE SAFETY AND PROFESSIONALISM THROUGH OPTIMIZING

Documentation and patient-staff communication: experience at aech-nori, islamabad

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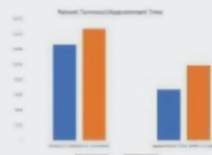


Figure 2: Comparison of patient turnover and appointment time

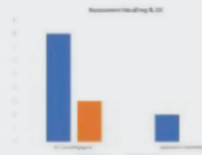


Figure 1: Comparison of equipment handling and QC issues



Figure 3: Comparison of patient handling & inconvenience



Figure 4: Comparison of image quality and misadministration

Materials & Methods:

This was a retrospective cross-sectional analysis. A survey and departmental meeting/survey was conducted headed by the head nuclear medicine & molecular imaging of AECH-NORI to assess the routinely occurring procedural mistakes, loopholes and issue as well as the attitude of nuclear medicine professionals towards these points. Furthermore, areas that need to be improved regarding imaging quality of diagnostic procedures especially nuclear cardiology and skeletal imaging. Local HMIS database from September 2020 to February 2023 was analyzed and queried for diagnostic procedures and main issues were identified that were mainly belonged to wrong administration, lengthy procedural time, lack of thorough equipment inspection including general inspection as well as quality control and misunderstanding or lack of patient-staff communication regarding patient safety were the main issues. Feedback forms, charts, and quality checks were devised in December 2021. Special emphasize was given to the pre-scanning instructions to the patients and it was ensured by the technologists for proper implementation. Hit and trial scanning was performed at different time intervals for optimization of time and image quality. Data was analyzed in February 2023 (15 months). It was compared with previous data from September 2020 to November 2021. A total number of patients, patient feed-back, quality control/ mishandling, image quality, technical mistakes (including injections and imaging at gamma cameras) were determined. Patient feed-back, quality control/ mishandling and image quality were assessed through log book and documentation rechecking, while image quality was assessed by the consultant nuclear physician by comparing the 10 images from pre- and post-intervention period each. Image noise-background ratio was observed and made its opinion from 1-10 points where 1-3 is poor, 4-6 satisfactory, 7-9 good and 10 was the excellent score. Pre- and post-intervention data was recorded and analyzed.

Results:

A total 390 working days were observed in 15 months of pre-intervention and during this period 12,616 patient were enrolled. On the other hand, 370 working days were observed in 15 months of post-intervention and during this period 14,704 patient scans were performed. This reflected increased patient turnover (figure 1). During the intervention period nearly 150 feedback forms were collected from patients, QC checklists were maintained properly and no day was missing and HOD conducted random survey to get feedback from patients regarding proper post-procedural instructions. Finally, a visible improvement was observed in equipment handling and quality control procedures by the technologists (figure 2). Misadministration of radiopharmaceuticals and other patient handling issues like unjustified prolonged stay at hospital were resolved at somewhat acceptable limits (figure 3). Image quality improved surprisingly despite lesser waiting time due to proper patient staff communication. Furthermore, contamination and extravasation of injected material also found lesser (figure 4).

Limitation:

Limitation: Our results are mainly based on the logistically possible inputs, as our study lacks the feedback from each and every patient as well as technical checklists are also missing for few days. Maintaining technical checklists, appropriate patient-staff communication and amassing feedback from all the patients is a full-time job and it's too difficult to do this task in its true letter and spirit with limited resources and smaller work force. So, in order to address this limitation work force must be increased and all other necessary steps must be engaged.

Background & Aims:

Nuclear medicine and molecular imaging have their own risks and hazards in this era of rapid diversification and technical advancements. As a result, nuclear medicine professionals face a variety of issues related to imaging quality, safety, and health care monitoring. Present study was planned to improve nuclear medicine procedural safety and professionalism, through optimizing documentation and patient-staff communication.

Conclusion:

Proper documentation and better patient-staff communication improves the procedural safety and professionalism in terms of less technical mistakes and patient conflicts, reduced procedural length and increased number of patients.