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Sensitivity and specificity of ^{99m}Tc-UBI$_{29-41}$ and ^{67}Ga-Citrate scintigraphy imaging to discriminate infection lesion induced by Staphylococcus aureus and sterile inflammation lesion induced by Carrageenan in foot's rat

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ABSTRACT: *This study was launched to evaluate the efficacy and efficiency of ^{99m}Tc-UBI$_{29-41}$scintigraphy imaging to visualize the infection foci induced by staphylococcus aureus and inflammation lesions induced by carrageenan in the foot's rat in comparison with ^{67}Ga-Citrate radioisotope scintigraphy imaging. The labeling and quality control of ^{99m}Tc-UBI$_{29-41}$have been performed according to the manufacturer's instructions. A total number thirty six adult, male NMRI rats were chosen. The animals were randomly divided into two equal group's .One group for ^{99m}Tc-UBI$_{29-41}$ scintigraphy imaging and the other group for ^{67}Ga-Citrate scintigraphy imaging respectively. Every group subdivided into two groups equally. Septic lesion was induced by Staphylococcus aureus due to inoculation of bacteria suspension in the foot's rat in one group. The aseptic inflammation lesion was induced by Carrageenan in the foot's rat in the other group.*
The ^{99m}Tc-UBI$_{29-41}$ and ^{67}Ga-Citrate radiotracer scintigraphy imaging studies have been performed to evaluate the sensitivity and specificity ^{99m}Tc-UBI$_{29-41}$radiopharmaceutical for preferentially diagnosis between infection and sterile inflammation lesions. The images have been shown the uptake ^{67}Ga at the infection and inflammation sites. The labeling of UBI by technetium can provide images with good quality and a shorter investigation time in comparison to ^{67}Ga radioisotope imaging. The infection foci could be visualized by ^{99m}Tc-UBI$_{29-41}$scintigraphy imaging due to selective bonding UBI $_{29-41}$ to the negatively charged groups present on the microbial membrane due to electrostatic interaction. The inflammation sites have been observed by non-specific uptake of ^{99m}Tc-UBI$_{29-41}$. Both scintigraphy imaging studies have not demonstrated preferentially diagnosis septic and aseptic inflammation lesions. The sensitivity, specificity and positive predictive value of both scintigraphy imaging techniques were 100%, 50% and 50% respectively. In spite of high sensitive of the ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging to localize the lesions, but it could not demonstrate to discriminate between septic and aseptic inflammation lesions. The other modalities must be considered for interpretation of images has obtained by ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging study.

KEY WORDS: *Carrageenan, ^{67}Ga, Staphylococcus aureus, ^{99m}Tc, ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging*

I. INTRODUCTION

Ubiquicidin (UBI) $_{29-41}$ is a small synthetic peptide with molecular weight 1.69 KD_a. The amino acid sequence of (UBI) $_{29-41}$ is Thr-Gly-Arg-Ala-Lys-Arg-Arg-Met-Gln-Tyr-Arg-Arg (Fig 1). This molecule has six positively charged residues (1, 2).

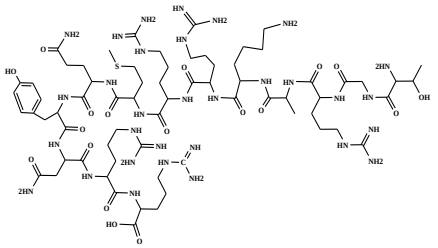

Figure 1 . UBI $_{29-41}$Structure

UBI $_{29-41}$ can bind selectively to the negative charged groups present on the microbial membrane by electrostatic interaction. The groups such as amino, thio and carboxyl with unshared electrons are present in the UBI $_{29-41}$ peptide molecule (UBI) $_{29-41}$ has potential characteristic for labeling by technetium -99m radioisotope. The process of labeling can be performed by ^{99m}Tc directly ^{99m} Tc-UBI $_{29-41}$or by using coligand reagents like 6-hydrazinopyridine 3-carboxylic acid(HYNIC)and tricine[^{99m} Tc/Tricine/HYNIC]UBI $_{29-41}$ indirectly(3,4). Therefore, ^{99m} Tc-UBI $_{29-41}$ has been developed as an imaging radiopharmaceutical to detect infection in nuclear medicine recently. ^{99m} Tc-UBI $_{29-41}$ and [^{99m}Tc/Tricine/HYNIC] UBI $_{29-41}$ have been shown rapid accumulation to the infection area and fast clearance with minimum liver uptake and hepatobiliary excretion (5).According to the literature, several experiments have been conducted to assess the efficacy and efficiency of new developed radiopharmaceutical to discriminate between septic and aseptic inflammation lesions. The different controversial results have been reported about sensitivity and specificity^{99m} Tc-UBI $_{29-41}$ scintigraphy imaging to diagnosis infection foci. Carrageenan induced-inflammation in rats as an in-vivo model of inflammation has been frequently used to investigate the anti-inflammatory effect of natural or synthetic products (6).Carrageenan induced-inflammation in experimental animals is one of the suitable models to study the efficacy of ^{99m} Tc-UBI $_{29-41}$scintigraphy imaging for preferentially diagnosis of infection from sterile inflammation lesions. This study was launched to investigate the sensitivity and selectivity of ^{99m} Tc-UBI $_{29-41}$and ^{67}Ga-Citrate scintigraphy imaging to detect infection induced by Staphylococcus aureus and sterile inflammation lesions induced by carrageenan in foot's rat.

II. MATERIALS AND METHOD

All chemical materials have been purchased from Merck, Fluka and Sigma. The chemicals and solvents were of the highest purity and analytical grade and used without further purification. The freeze-dried kits [Tricine/HYNIC] UBI $_{29-41}$ and ^{99}Mo/^{99m}Tc generator have been provided by Radioisotope Division of Atomic Energy Organization of Iran. Production of ^{67}Ga was performed at the Agricultural Medical and Industrial Research School (AMIRS ,Karaj ,Iran) using a 30 Mev cyclotron (Cyclone-30,IBA,Belgium).Enriched Zinc 68 chloride(enrichment >95%) was obtained from the Ion Beam Separation Department at AMIRS.

2.1. Bacteria Sample

The sample wound swabs were taken from patients admitted to the infection department of teaching center of Imam Khomeini hospital, Ahvaz, Khuzestan, Iran. The specimens were transported in sterile, leak-proof container to the department of microbiology of Ahvaz Jundishapur University of medical Sciences. The isolates were inoculated on blood agar and incubated overnight at 35 ° C aerobically. Gram-positive cocci occurring in pairs, short chains or clusters, that they were Catalase-positive, Coagulase-positive by test tube and DNase-positive on agar were identified as S.aureus and selected. By using a sterile-tip applicator, touch the surface of one to four morphologically identical, isolated colonies. Immerse the applicator into a tube containing Mueller Hinton broth. Rub the applicator against the wall of the tube slightly to release a small amount of growth into the liquid. Cap the tube and mix the cells using a vortex to form a suspension, being careful not to form froth or bubbles in the suspension when mixing the cells. The broth was incubated at 35 °C, and then the turbidity was adjusted to a number 0.5 McFarland turbidity standard .A sterile cotton swab on a wooden stick was dipped into the broth.

Excess inoculum was removed by rotating the swab against of the tube above the fluid level wall. The Mueller-Hinton agar plates were streaked in three dimensions. The plates were inoculated at 35 °C for 24 hours. The turbidity was adjusted to a number 0.5 McFarland (each milliliter of 0.5 McFarland contains 1.5×10 ^{8}microorganisms). Half milliliter of inoculums has been injected to each foot's rat. To make sure about the survival of S aureus bacteria, 0.1 milliliter of the above mentioned inoculums was inoculated on blood agar. The experiment has been repeated three times.

2.2. Animal study

The rats with average weight 160±20 gr were obtained from research center and experimental animal house of Ahvaz Jundishapur University of medical Sciences. This approach was approved by the ethics committee of Ahvaz Jundishapur University of medical Sciences. All the ethical issues were considered based on the Ahvaz Medical University Ethical Protocols (AMUP) on animal experiments. A total number of thirty six adult, male NMRI rats were acclimated to conditions for one week before the experiment. These rats were kept in individually wire-bottom stainless steel cages in an air-conditioned room at 24±1°C with a 12 hours light-dark cycle and were fed with standard pellet diet and had free access to water.

They were randomly assigned into two equal groups. One group has been allocated for ^{67}Ga-Citrate and the other group for ^{99m} Tc-UBI $_{29-41}$scintigraphy imaging studies. Every group has randomly divided into two groups. Each group contained nine animals. Staphylococcus aureus infection was induced in the right thigh muscle of animals by intramuscular injection of bacteria suspension. In the other group carrageenan was dissolved in normal saline in order to produce inflammation in animals. On the experiment day, under brief

diethyl ether anesthesia one milliliter of 3 % carrageenan solution in saline was injected intramuscularly in the right thigh muscle of animals. Carrageenan caused visible redness and pronounced swelling that was developed two hours after injection, maximal between two to four hours after injection and persisted for more than twenty four hours.

2.3. Labeling of [Tricine/HYNIC] UBI $_{29-41}$ by ^{99m} Tc

Technetium-99m as sodium pertechnetate ($Na^{99m}TcO_4$) was obtained from an in-house $^{99}Mo/^{99m}Tc$ generator using 0.9% saline. Commercial [Tricine/HYNIC] UBI $_{29-41}$ kits (AEOI, Tehran, Iran) was used. Labeling of the kit [Tricine/HYNIC] UBI $_{29-41}$ was performed by adding 0.5 ml of saline in an evacuated vial and shaked, the mixture was allowed to preincubated for 5 min at room temperature then (555-740 MBq) of freshly eluted ^{99m} TcO4 in 0.5 ml of saline was added to the vial and incubated for 10 min in water bath at 100 °C.

2.4. Quality Control

Radiochemical purity analyses were performed by Instant Thin-Layer Chromatography (ITLC) by using Whatman No.3 filter paper chromatography as the stationary or solid phase and different solvent systems as mobile system. Samples of the preparations containing labeled peptide were applied at the approximately 1 cm from the bottom of ITLC strips and allowed to dry at the room temperature and then placed in air-tight containers with different solvent systems. Then the strips were cut to ⅓ lower and ⅔upper and counted (by Aktivimeter, Ziemens, Germany) for 2min under a single head gamma camera equipped with a low energy all-propose collimator. Using an energy peak centered a 140 Kev.

The quality control of [^{99m}Tc/Tricine/HYNIC] UBI $_{29-41}$ was performed as follow according to manufacturer's instructions: 2-butanone for free ^{99m} TcO4 (R_f =1),0.1 M Sodium Citrate ,P_H =5,to determine the non peptide –bound ^{99m}Tc coligand and ^{99m} TcO4 (R_f =1) and Methanol/ 1 M Ammonium Acetate 1:1 for ^{99m} Tc colloid (R_f=0),R_f values of [^{99m}Tc/Tricine/HYNIC]UBI $_{29-41}$ in each system equal 0.0and 0.8-1 respectively.

2.5. Scintigraphy imaging study

Radioisotope scintigraphy imaging studies have been performed 48 hours after inoculation of bacteria samples for visualizing of the infection sites. These studies have been performed two hours after carrageenan induced-inflammation. In all studies, each rat was placed in the restrainer apparatus and the (37MBq) ^{99m} Tc-UBI $_{29-41}$or ^{67}Ga-Citrate was administered intravenously by contra lateral tail vein. The subjects returned back to their cage and the experiment continued. One hours after injection of ^{99m} Tc-UBI $_{29-41}$radiotracer and eight hours after ^{67}Ga-Citrate radioisotope, the rat was anesthetized with diethyl ether. The anesthetized live rat was placed in a prone position with limbs spread out and fixed on the board with surgical tape for scintigraphy imaging. For all studies a single-headed camera (E-Cam, Siemens USA) was used.

2.6. ^{67}Ga imaging

^{67}Ga-Citrate was injected intravenously by contra lateral tail vein. Images were obtained eight hours later using a large field of view gamma camera with a medium –energy, general purpose collimator. Anterior and posterior images were acquired for 500 kilo counts, using three peaks of ^{67}Ga (93,185 and 300 KeV) with windows of 20% centered on each peak. The gamma camera was positioned to image the affected part and contra lateral healthy site (Fig2).

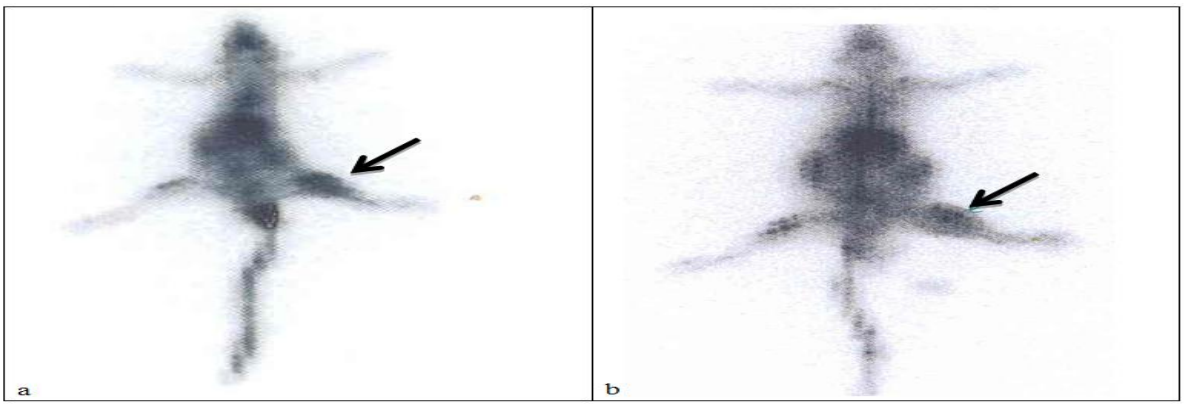

Figure 2. ^{67}Ga-Citrate scintigraphy imaging study has been performed eight hour after 37 MBq radiotracer injected by contra lateral tail vein. The posterior view images demonstrated lesions a: infection induced by Staphylococcus aureus b: sterile inflammation induced by Carrageenan.

2.7. ^{99m} Tc-UBI $_{29-41}$imaging

Following an intravenous injection of 37MBq ^{99m} Tc-UBI $_{29-41}$, imaging was performed at one hour post injection. Anterior and posterior static images were acquired using a large field of view gamma camera peaked to 140 keV with a 15% window and a low –energy all –purpose collimator for 500kilo counts per image. The gamma camera was positioned to image the affected part and contra lateral healthy site (Fig 3).

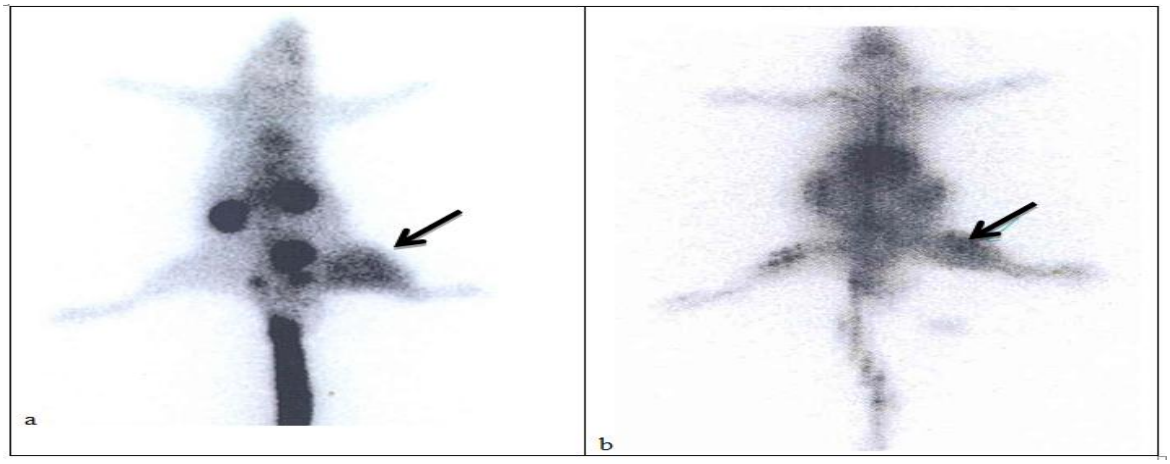

Figure 3.Posterior view images have been obtained one hour after 37 MBq

^{99m}Tc-UBI$_{29-41}$ administrated intravenously due to contra lateral tail vein. The images indicate lesions a: infection site induced by Staphylococcus aureus b: Carrageenan induced-inflammation

III. RESULTS

The yields of ^{99m}Tc-UBI $_{29-41}$ complex samples were approximately 81 %. Three independent nuclear physicians were responsible to interpret the images and their final opinion was achieved by consensus. The observers were unaware the cause of induced lesions in the foot's rats. All lesions were induced in the right foot of rats in order to exclude any misinterpretation of images. The uptake of radiotracer in the affected foot as region of interest (ROI) in comparison to the contra lateral healthy side have considered in all studies. Accumulation of radiotracer in ROI has been observed in each case. Preliminary studies indicated that the images were clear and apparent when^{67}Ga-Citrate scintigraphy imaging has performed 8 hours after administrated the radioisotope. ^{67}Ga-Citrate radioisotope imaging studies have been shown both infection and sterile inflammation sites. ^{67}Ga-Citrate scintigraphy scanning could not discriminate between septic and aseptic lesions. The ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging showed rapid distribution at the affected area as region of interest. Both infected and sterile inflamed lesions have been observed by ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging study. The ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging could not extinguish distinct infection from sterile inflammation foci. The ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging has not shown any additional information about the differential diagnosis of infection foci in comparison to ^{67}Ga-Citrate radioisotope imaging in our approach. The labeling of UBI by technetium can provide images with good quality and a shorter investigation time in comparison to gallium 67 radioisotope imaging could be considered as an advantage of ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging. According to the data have obtained from this investigation the sensitivity of both scintigraphy images were 100%, specificity 50% and positive predictive value (PPV) 50%.

IV. DISCUSSION

The accuracy of a clinical diagnosis is the most challenging step for every clinical practice. Appropriate treatment is usually the result of a perfect diagnosis with high accuracy. Distinct distinguish between septic from aseptic lesion is one of the most problems in medicine. Several modalities have been suggested to find the solution of this dilemma. The available imaging techniques such as Plain Radiography, Ultrasonography, Magnetic Resonance Imaging (MRI) and Computed Tomography (CT) have high sensitive but are not specific for infection especially in early phases, when anatomic structures have not been distorted. Radioisotope scintigraphy imaging may be considered as part of the diagnostic procedures to detect infection. The radioisotope 67 gallium is the most primitive radionuclide for this purpose but it has several disadvantages like long physical half-life, multiple energy gamma ionizing radiation causing high radiation absorbed doses, is not available as generator and high sensitive for both infection and non-infectious inflammation (7,8).The radio labeled leukocytes have been recommended as a gold standard for the scintigraphy imaging to visualize infection from sterile inflammation lesions in nuclear medicine . In order to prepare the label leukocyte, the

blood must be taken from the patient and, the leukocyte separated, labeled and finally reinjected to the patient. This technique is time-consuming and has potentially the risk of contamination or transmission of blood-borne pathogens to patient or technician. In addition to above mention factors, specialize facilities have been required for the process of labeling of leukocytes with radioisotope (9, 10).

^{99m}Tc-UBI $_{29-41}$ radiopharmaceutical kits have been established as an infection seeking agent. There have been extensive studies for ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging for a variety of infections including bone infections, soft tissue infections, prosthesis and fever of unknown origin (UFO). Akhtar et al., investigated the efficacy of ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging in eighteen patients suspected with bone, soft-tissue and prosthesis infections. They reported that the ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging has overall sensitivity, specificity and accuracy as 100%, 80% and 94.4% in detecting infection lesions (11).

Melendez-Alafort et al., studied the biokinetic of ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging in comparison to ^{67}Ga-Citrate scanning in six children suspected with bone infection. They concluded that the ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging has adequate biokinetic properties and ability to detect infection foci in humans (12).
Vallejo et al., evaluated the clinical use of ^{99m}Tc-UBI $_{29-41}$ images in thirteen patients with suspected mediastinitis after cardiac surgery. They reported the sensitivity, specificity, positive predictive value, negative predictive value and overall diagnostic accuracy for detecting patients with mediastinitis 83%, 100%, 100%, 87% and 92% respectively (13).

Sepulveda-Mendez et al ., studying ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging for detecting infection foci in 196 patents with FUO, reported that specificity , sensitivity ,accuracy, positive predictive value and negative predictive value of ^{99m}Tc-UBI $_{29-41}$ for localizing infection foci 95.35% ,97.52%, 96.62%, 96.72% and 96.47% respectively. They concluded that the ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging could be considered as the gold standard in molecular imaging of infection sites (14).Dillmann-Arroyo et al., evaluated the clinical application of ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging in twenty seven patients suspected with vertebral osteomyelitis .They reported the sensitivity and specificity of ^{99m}Tc-UBI $_{29-41}$images for visualizing infection sites 100% and 88%(15). Aryana et al., investigated the value of ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging in thirty four patients with painful hip prosthesis to detect infection foci. They reported the sensitivity, specificity, positive and negative predictive value 100%. They concluded that the ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging with its high sensitivity and specificity, provides the physician with an excellent tool for differentiating infection from aseptic loosening of hip prostheses (16). Relative high sensitivity, specificity and accuracy of ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging in the detection of infection lesions indicate high potential of this radiotracer as an infection tagging radiopharmaceutical. These promising results are partly due to the microorganism inducing infection. Staphylococcus aureus is one the most infectious pathogens. Akhtar et al., studied the bacterial infection seeking potential of ^{99m}Tc-UBI $_{29-41}$ in Staphylococcus aureus and Escherichia coli induced infections. They demonstrated that the uptake of ^{99m}Tc-UBI $_{29-41}$ less in Escherichia coli infection than in Staphylococcus aureus infection (17). Alizadeh Otaghvar et al., investigated the role of ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging in comparison to ^{99m}Tc-IgG scan in twelve patients suspected with acute appendicitis. They reported that the ^{99m}Tc-UBI $_{29-41}$ scintigraphy images of all patients were negative. Escherichia coli bacteria are the most common cause infection agent involved in the pathogenesis of acute appendicitis. For this reason the value of ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging for detection of appendicitis is not as efficient as for other types of infections in which Staphylococcus aureus is the predominant infectious agent (18).Ferro-Flores et al., studied the specificity of ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging in comparison of ^{67}Ga-Citrate to detect infection lesion induced by Staphylococcus aureus and inflammation lesion induced by heat killed gram negative bacteria in the left thigh of mice. They found that the ^{99m}Tc-UBI $_{29-41}$ demonstrated minimal accumulation in the inflamed muscle with respect to the infected thigh (19).They concluded that the ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging has specificity for visualizing infection sites. The result from our approach has not confirmed such selectivity for ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging to discriminate preferentially septic from aseptic lesions. This discrepancy could be related to the experimental model used in our investigation. Carrageenan is a natural polysaccharide obtained from edible red seaweeds. Carrageenan induced-inflammation is widely used test to investigate anti-inflammatory activity and constitutes a simple and routine animal model for evaluation of pain at the site of inflammation, without any injury or damage to the inflamed tissue (20- 22). The development of inflammation following the injection of carrageenan has been described as biphasic in which various inflammatory mediators operate in sequence to produce the inflammatory response. There are several mediators involved in inflammation. Histamine, serotonin and bradykinin are the first detectable mediators in the early phase of carrageenan induced-inflammation. Prostaglandins are involved in the increased vascular permeability and are detectable in the late phase of inflammation. Local and systemic inflammation is associated with enhanced levels of the pro-inflammatory mediators' such as Tumor Necrozing Factor (TNF), Interleukin 1(IL-1) and Il-6 (23). Local neutrophil infiltration and activation also contribute to this inflammatory response by producing among other mediators. Oxygen-derived free radicals like superoxide anion and hydroxyl radicals have been suggested to involve in the inflammatory response induced by Carrageenan (24).

The artificial sterile inflammation processes can be induced by carrageenan test in experimental animals. It has provided to assess the potential of radioisotope scintigraphy imaging to discriminate between septic and sterile inflammation lesions. ^{67}Ga-Citrate has been used for visualizing infection lesions in nuclear medicine.^{67}Ga is produced by cyclotron and emitted four principal gamma rays (93,184,296 and 388 KeV) suitable for imaging. The exact mechanisms for the ^{67}Ga-Citrate uptake at the infection and inflammation sites have not been elucidated. Several explanations have been proposed. These include uptake of ^{67}Ga by leucocytes, bacteria and plasma protein binding by transferrin and lactoferrin. Increased blood flow and increased vascular membrane permeability result in enhanced delivery and accumulation of ^{67}Ga-transferrin at inflammation sites. ^{67}Ga can also bind to lactoferrin, which is present in high concentration at the inflammation sites. Direct uptake by certain bacteria has been observed in vitro, and this may account for ^{67}Ga uptake in infection. Siderophores, low-molecular weight chelates produced by bacteria, have a high affinity for ^{67}Ga. ^{67}Ga-siderophore complex is presumably transported into the bacterium, where it remains until phagocytosed by macrophages (25).For the above mentioned factors, ^{67}Ga-Citrate scintigraphy imaging study could not differentiate the infection foci induced by S aureus and the inflammation lesions induced by Carrageenan. From the experiments reported in literature, UBI $_{29-41}$ is a synthetic antimicrobial peptide and this molecule has six positively charged groups and binds directly to the negatively charged groups present on the microbial membrane by electrostatic interaction. The accumulation of ^{99m}Tc-UBI $_{29-41}$ in Staphylococcus aureus is sufficient amounts to provide images with suitable quality. Therefore, the infected sites could be visualized by ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging study in our investigation. The exact mechanism of localizing ^{99m}Tc-UBI $_{29-41}$ at the inflammation foci is not elucidated. Non-specific uptake of^{99m}Tc-UBI $_{29-41}$ radiotracer at the inflammation foci induced by carrageenan could be explained by the following assumptions. The local congestion and increased vascular permeability caused by Carrageenan could deliver more ^{99m}Tc-UBI $_{29-41}$ radiotracer at the affected region area. In addition to above factors, the present specific receptors with negative charge groups may be relevant. Therefore, ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging has not shown any advantages to ^{67}Ga-Citrate radioisotope imaging to discriminate between infection and sterile inflammation in our assessment. This study was one the first studies performed to evaluate the efficacy and efficiency of ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging study to differentiate septic and sterile inflammation lesions by using an experimental animal model. This matter could be considered as a positive point of our investigation. We could establish a new developed technique in nuclear medicine to assess accuracy of any radiopharmaceutical kits has been suggested as an infection imaging agent.

V. CONCLUSION

The ^{99m}Tc-UBI $_{29-41}$ scintigraphy imaging was high sensitive to localized affected region area but it could not demonstrate selectivity for distinct detection infection and sterile inflammation lesions in our approach. It is mandatory to consider the other modalities for intelligent interpretation of ^{99m}Tc-UBI $_{29-41}$scintigraphy images.

Conflict of Interests: The authors hereby declare that there is no conflict of interests.

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