International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Impact Factor (2012): 3.358

Assessment of Clinical, X-Ray and CT in Diagnosis of Paranasal Sinus Diseases

Abbas O. Hussein[1], Bushra H. Ahmed[2], Mohammed A. Ali Omer[3], Mohammed F.M.Manafal[4], Ali B. Elhaj[5]

[1]Sudan University of Science & Technology, College of Medical Radiological Science, Al-Ghad International Health Sciences Colleges, Radiology Department-Buraduh-KSA, Khartoum-Sudan

[2]The National Ribat University, Faculty of Medicine, Khartoum-Sudan

[3]Sudan University of Science & Technology, College of Medical Radiological Science, Qassim University, College of Applied Medical Science, Buraidah-KSA

[4]Qassim University, College of Applied Medical Science, Buraidah-KSA

[5]Sudan University of Science & Technology, College of Medical Radiological Science, Al-Ghad International Health Sciences Colleges, Radiology Department-Buraduh-KSA, Khartoum-Sudan

Abstract: ***Para nasal sinuses diseases are common and include wide spectrum ranging from inflammation to neoplasm. They have been evaluated to reveal the value of clinical diagnosis, water's view technique relative to CT exam at Ear Nose Throat at Khartoum specialist hospital among a total of 240 patients and their ages ranged from 8 to 95 years old. Based on the clinical history and the examinations of X-ray paranasal sinuses (PNS) (Water's view) and CT-PNS, the analysis revealed that: the female were commonly involved with paranasal sinuses pathologies with 54% relative to males 46%, the common involved age with sinuses pathologies was 19-29 years old taking 29.2%, the common pathologies involving sinuses were polyp, chronic sinusitis and acute sinusitis with a percent of 33.8%, 23.8% and 17.1, respectively, while the symptom were the nasal obstruction, nasal discharge and headache with a percent with a percent of 87.9%, 69.2% and 60.4 respectively, maxillary sinus was the common involved sinuses with a percent of 72.1%, followed by the ethmoidal, frontal and the sphenoidal sinuses with a percent of45.4%, 31.7%, 27.2% respectively. When the sensitivity and specificity of clinical diagnosis (CD) versus CT diagnosis correlated it revealed that the CD has a considerable sensitivity and specificity in diagnosis of acute and chronic sinusitis as (97.6%, 91%) and (93%, 75.4%) respectively and when the sensitivity and specificity of water's view technique diagnosis versus CT diagnosis correlated it revealed that the water's view technique has a considerable sensitivity and specificity in diagnosis of acute sinusitis at 87.8% and 92% respectively.***

Keywords: Diagnosis, Radiography, Paranasal Sinuses, Clinical, X-ray, CT,

1. Introduction

The Para-nasal sinuses are hollow, air-filled spaces located within the bones of the face and base of the skull surrounding the nasal cavity. There are four pairs of sinuses, each connected to the nasal cavity by small canal. They include the frontal, ethmoidal, maxillary and sphenoid sinuses [1]. The paranasal sinuses are found by three essentially components; thin normal mucus secretions, normally functioning hair-like cilia that move the mucus out of the sinuses and open sinus drainage openings (called sinus ostium). Any condition (Inflammation, neoplasm, foreign body) that interferes with drainage of a sinus renders it liable to infection [2]. Para nasal sinuses lesions are common and affect a wide range of population with a variety of etiologies. They include a wide spectrum ranging from inflammation to neoplasms.

It is recently evident that sinusitis is primarily a clinical diagnosis. When the clinical history suggests sinusitis, a directed physical examination can help to differentiate sinusitis from simple upper respiratory tract infection [3]. The aim of history taking is to evaluate the presence, severity and duration of symptoms in order to obtain an accurate diagnosis. Physical examination aims to find any abnormality or disease that can explain the symptoms. Inspection, palpation and anterior rhinoscopy are easy and rapid ways to examine any nasal problem [4]. The emphasis on obtaining a patient history and performing a limited physical examination is based on the fact that most patients can be effectively treated (medically and cost-wise) without the necessity of nasal endoscopy, radiographic studies or bacterial cultures [5]. Imaging of the sinuses is usually reserved to give information that supports the clinical findings, or to confirm the diagnosis if history and physical examinations are equivocal, or if conventional treatment has failed. Modalities include plain radiograph, CT, ultrasound and MRI [6]. Computed tomography (CT) is the imaging modality of choice for the diagnosis and follow-up of patients with sinus pathology. But CT scanning is not without risk to the patient. The radiation dose & cost associated with CT scan make its use as primary diagnostic tool for rhinosinusitis inappropriate. Whereas, provisional diagnosis could be on the basis of clinical history and physical examination, radiology and sinus endoscopy are necessary in making definitive diagnosis and management protocol. Plain radiography is the mainstay of radiological diagnosis in most developing countries because it is cheap, simple and widely available. This study aimed to evaluate the diagnostic value of clinical diagnosis and sinus radiography for diagnosing paranasal sinus diseases by comparing with sinus CT in the clinical setting.

2. Methodology

This prospective correlational descriptive clinical study was done in ears Nose Throat E.N.T Khartoum specialist hospital, Ibn El Haitham diagnostic center, Khartoum advanced diagnostic center and Antalya medical center. Data was collected in the period from (1.8.2012) to (1.1.2014). A total of 240 patients.129 patients were females while the 111were males and their ages were ranged from 8 to 95 years old. All patients presented with clinically suspected paranasal sinuses diseases. The selected patients were subjected to detailed history and relevant Clinical examination and underwent to x-ray PNS (Water's view) and CT-PNS examination in both coronal and axial planes.

X-ray paranasal sinuses were performed by Toshiba X-ray machine 2003, unit model.drx-3724 hd ma .voltage:150 kvp. Focal spot: 1.2/0.6 mm. Waters' view examination was conducted by angling the patient's orbitomeatal line (OM L) 37degrees to the table or the image receptor (IR), with his or her mouth open in order to visualize the ethmoid and sphenoid sinuses; the central ray (CR) was set perpendicular to the subject's head exit at acanthion., at a source image distance (SID) of 100 cm (40 inches); In order to prevent unnecessary exposure to radiation, the collimated f field, was limited to a range covering just the four sinuses. Exposure Factor was 75 Kvp and 20 mAs.

For both scanning techniques (axial and coronal), American, general electric (GE) Hi Speed CT/E Dual CT Scanner was used. The patient was imaged in the supine position with their head entering the gantry first. As coronal and axial views were obtained from scout images using the top of the head as land mark , data from the top of the head to the bottom of the nasal cavity were collected through continuous images of scan in helical mode (slice thickness: 1 mm, interval: 5 mm, KV: 120, mAs: 77).

3. Results and Discussion

Figure 1 shows the common involved gender with sinuses pathologies. It shows that the common involved gender with sinuses pathologies was the Female, with a percent of 53.7% relative to male. Such high incidence among female could be ascribed to fact that ; women exposure to dust and smoking from home cleaning and cooking more than men and these lead to allergic rhinitis which is the causative factor in sinusitis. Another causative factor is rhinitis of pregnancy. Recent theories of sinusitis indicate that it often occurs as part of a spectrum of diseases that affect the respiratory tract and is often linked to asthma thus women are known to have higher prevalence and severity of asthma [7]. Same results have been noticed by Timmanagouda [8] in which he found that the incidence percent among female was 65.4% relative to male (34.6%).

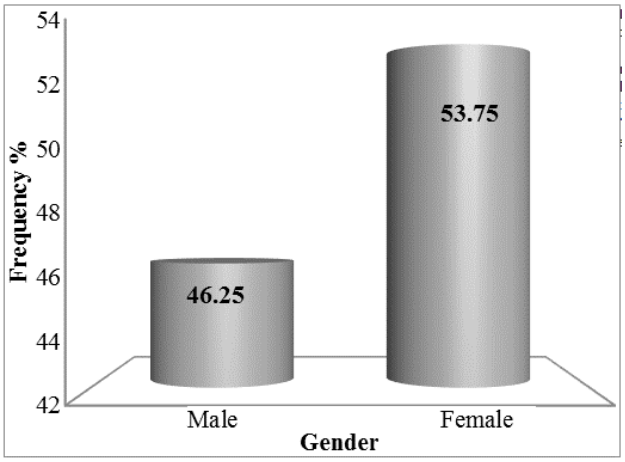

Figure 1: shows the common involved gender with sinuses pathologies in percent.

Figure 2 Figure 4.2 shows the distribution of sinuses pathologies based on age wise. In which it reveals that the sinuses pathologies started in age group of 8-18 years old, then the incidence increases and approaching to plateau at 29.2% as a common involved age with sinuses pathologies 19-29 years old, then the curve of incidence declines following aging. The high incidence among age group of 19-29 years old could be ascribed to more expose to the environment, recurrent upper respiratory tract infections, irregular check-up and treatment. Same result has been obtained by Ologe and Olatunji [9] they found the high incidence among age group of 16-30 years old .Saied that these findings corroborate the findings by earlier workers and scribe the less common incidence in children to wide ostia and some of their sinuses are not fully developed. These factors could reduce the chances of sinus obstruction that could lead to sinusitis. Moreover, patients above the age of 60 years (elderly) were not many in our series; this could be due to the low life expectancy in our environment and the unwillingness of more elderly patients in our environment to seek orthodox medical attention.

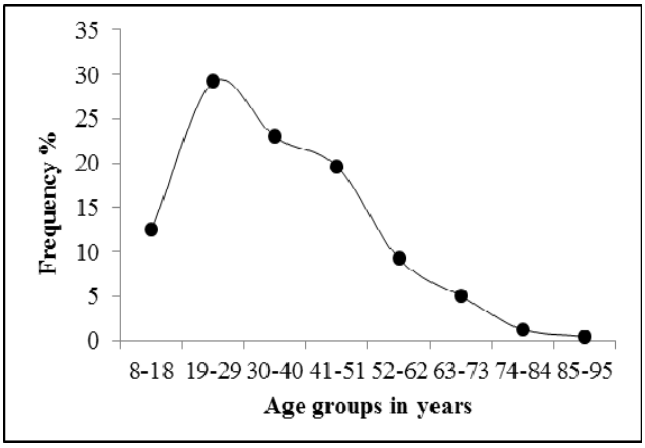

Figure 2: shows the distribution of sinuses pathologies based on age wise.

Figure 3 shows the pathologies of paranasal sinuses in percent. It reveals that: the common involved pathology with sinuses was the polyp, with a percent of 33.8% and the following common pathologies were chronic sinusitis and acute sinusitis with a percent of 23.8% and 17.1, respectively

.of Such high incidence in polyp could be ascribed to Low socio-economic factors and overcrowding which are prevalent in our society might. Same results in Sudan have been noticed by Timmanagouda [8] in which he found that the incidence percent was 16% for nasal polyp and 16%, 14% for acute and chronic sinusitis respectively.

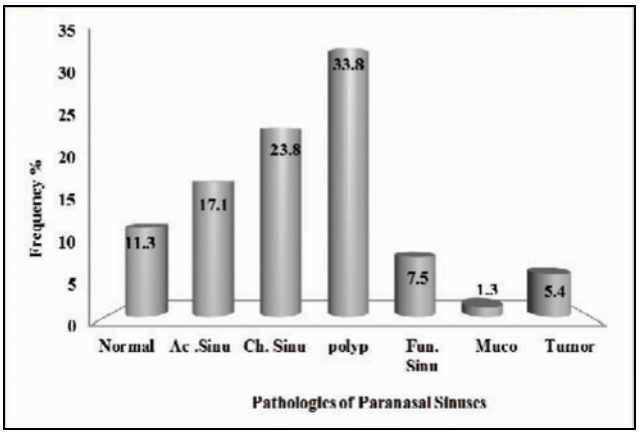

Figure 3: shows the pathologies of paranasal sinuses in percent

Figure 4 shows the symptoms in percent. It reveals that: the common involved symptom was the nasal obstruction, with a percent of 87.9% and the following common symptoms were nasal discharge and headache with a percent of 69.2% and 60.4 respectively. Of Such high incidence could be ascribed to swelling of the mucosa of the nasal cavity and paranasal sinuses. An excess amount of secretion leads to nasal discharge anteriorly or posteriorly. Also an excess amount of secretion which cannot be released cause pressures which cause a headache. Same results have been noticed by Srinivasa et al, [10], in which he found that the, nasal obstruction with a percent of 48% followed by headache with a percent of 42% and nasal discharge with a percent of 36%.

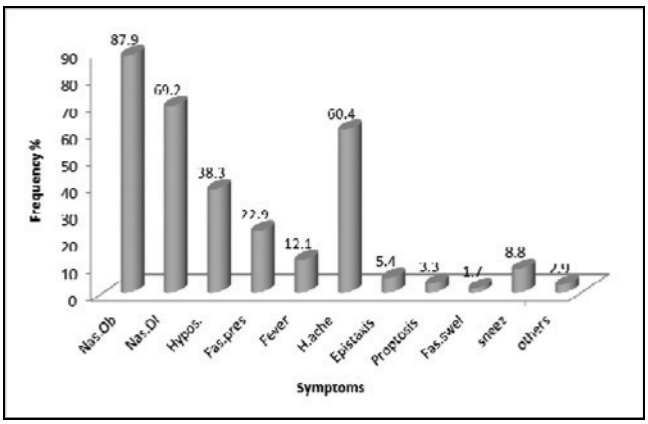

Figure 4: shows the symptoms of Paranasal Sinuses in percent

Figure 5 shows the involved paranasal sinuses in percent water view in comparison with CT. It reveals that the common involved was the maxillary sinus, with a percent of 72.1%.followed by the ethmoidal, frontal and the sphenoidal sinuses with a percent of45.4%, 31.7%, 27.2% respectively.

this result could be scribe to anatomical location of the frontal, ethmoidal and the sphenoidal sinuses witch anatomically located above the nasal cavities, therefore, their drainage into the nasal cavity is assisted by gravity; especially when their openings are not obstructed by disease, so that changes or alterations in the aforementioned paranasal sinuses may initially be subtle and not a radiological evident until it becomes extensive with blockage of sinus openings. On the other hand, poor anatomical position drainage predisposes the maxillary sinus to stagnation of secretions and infection more than any other paranasal sinus. Same results have been noticed by Maduforo [11] in which he found that the maxillary sinus with a percent of 66.7% followed by the ethmoidal, frontal and the sphenoidal sinuses with a percent of34.2%,12.5%,1.7% respectively.

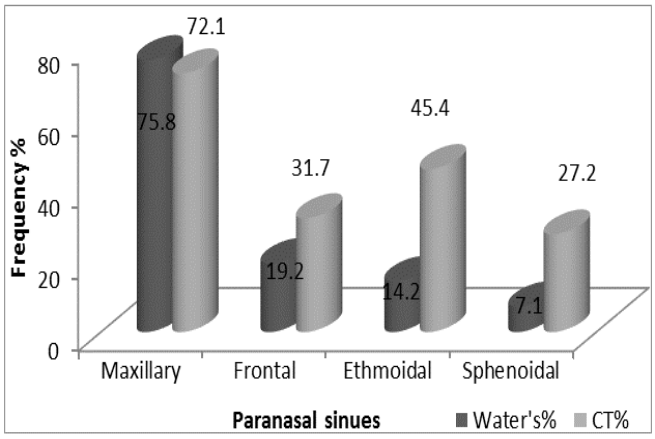

Figure 5: shows the involved paranasal sinuses in percent water view in comparison with CT.

Figure 6 shows the sensitivity and specificity of clinical diagnosis (CD) versus CT diagnosis. It reveals that: the CD has a considerable sensitivity and specificity in diagnosis of acute and chronic sinusitis as (97.6%, 91%) and (93%, 75.4%) respectively, such results for acute could be ascribed to high sensitivity and specificity of three basic symptoms which are; purulent (not clear) nasal drainage, nasal obstruction and facial pain-pressure-fullness, or both [12].Therefore the CD could be used significantly in diagnosis of acute sinusitis, while the chronic sinusitis is non due to low specificity (75.4%). Such variation could be ascribed to the fact that: the symptoms are multiple and vague, while examination is often limited as sinuses cannot be examined directly. Anterior rhinoscopy gives little information about middle meatus and osteomeatal unit which is consider as the common affected area. Symptoms of chronic sinusitis (CRS) alone are not sufficient to diagnose CRS because they can be nonspecific and mimicked by several disease entities (eg, upper respiratory tract infection, migraine). Conformation of sinus disease using an objective measure is required. Conversely, in the absence of symptoms, diagnosis of CRS based on radiology alone is not appropriate because of a high incidence of radiologic anomalies on CT scans in normal individuals. Thus, the presence of symptoms and an objective finding are necessary i.e. CT exam. Same results have been noticed by Ruqqayia et al, [13] in which they found that the acute sinusitis had a

sensitivity of 100% and specificity of 78% and chronic sinusitis had 100% sensitivity and 74.1% specificity.

The rest of other pathologies as Nasal polyps, Mucoceles, fungal sinusitis, tumors have low sensitivity and/or specificity relative to CT in diagnosis, which is due to a number of subjective symptoms and a few findings in physical examination which are in turn are inherently vague and not sensitive enough for a clear cut diagnosis. Although of this low sensitivity and/or specificity relative to CT, a CT should be interpreted in the context of the history and examination; as the prevalence of incidental mucosal changes in an asymptomatic population is approximately 30% [14].

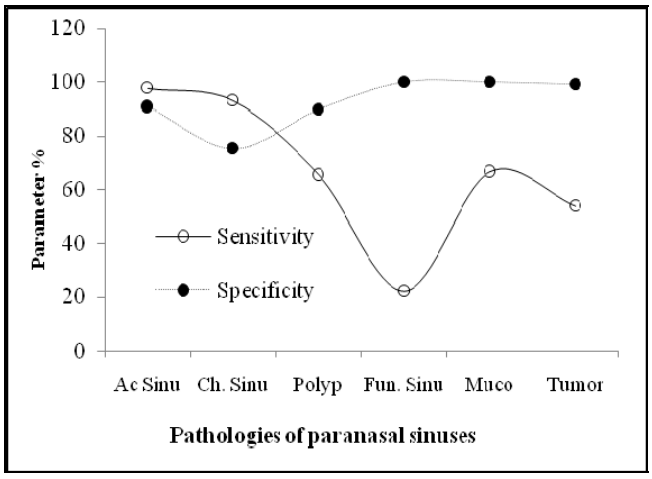

Figure 6: shows the sensitivity and specificity of clinical diagnosis versus CT diagnosis.

Figure 7 shows the correlation of water's view versus CT diagnosis. It reveals that: an acute sinusitis followed by chronic sinusitis are better diagnosed by x-ray (water's view technique) which showed a sensitivity and specificity at 87.8% and 92% respectively for acute and 60.7%, and 61.4% for chronic sinusitis respectively, such results have mentioned by Piyynchiul et al, [15] and Ruqqayia et al, [13] in which they found that the acute sinusitis had a sensitivity of 80% and specificity of 85%; while the chronic showed a sensitivity of 58% and specificity of 53%. Therefore the x-ray (water's view technique) could be used significantly in diagnosis of acute sinusitis. The shortage of water's view technique could be ascribed to anatomical causes such as: hypoplastic sinus, orbital floor fissure, superior orbital fissure and zygomatic recess which could appear as false clouding and opacification and false mucosal thickening and technical causes such as:

1) Soft exposure which can cause an impression of clouding of maxillary sinuses.
2) Lateralization of radiographic tube which can cause mucosal thickening on the side of lateralization to be missed in the radiograph
3) Inadequate tilting of tube head which can cause an artificial impression of presence of fluid level.
4) Marked tilting of tube head which can cause impression of clouding of maxillary sinuses [16].

Out of deducing: the water's view technique cannot distinguish between acute sinusitis and chronic sinusitis because they have the same findings as: mucosal thickening, air-fluid level and partial or total sinus opacification of paranasal sinuses; and only the clinical presentation and duration of symptoms can distinguish between them. Acute sinusitis has short and limited duration in comparison with chronic sinusitis which has long duration and then interferes with all other sinus diseases. The rest of sensitivity and specificity of water's view technique for polyps, fungal sinusitis, mucocele, tumors were as follows: (33%, 99%), (0%, 100%), (66.7%, 100%) and (30.8%, 99.1%) respectively.

The low sensitivity and/or specificity of all these diseases indicate the shortage or weakness of water's view technique to estimate and diagnose the soft tissue disease, bone erosion and osteomeatal complex of the sphenoid/ethmoid sinuses and many of the findings and diagnosis are missed. Other study by Ahmad et al, [16] ascribed this shortage of water's view technique to inability to differentiating between infection, tumor and polyp in an opacified sinus.

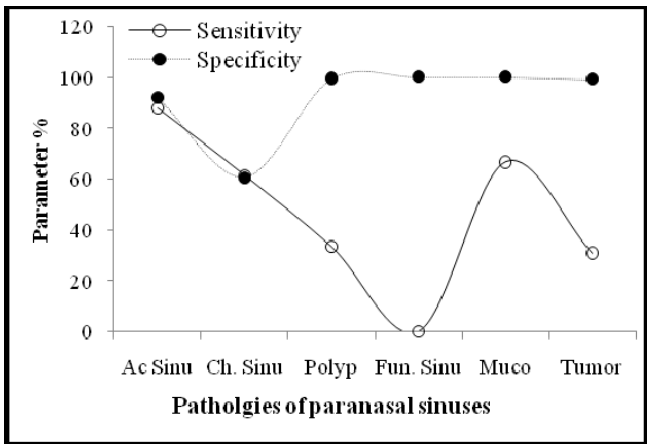

Figure 7: shows the sensitivity and specificity of water's view technique diagnosis versus CT diagnosis.

4. Conclusion

In diagnosis of paranasal sinuses pathologies, using clinical method, X-ay (water's view technique) and CT imaging, the clinical methods shows an accurate (significant) utilization in diagnosis of acute sinusitis and acceptable limit to diagnose chronic sinusitis relative to CT as gold standard method, with obvious consideration to radiation protection point of view, while the water's view technique can only be applicable in diagnosis of acute sinusitis while fell in other pathologies.

References

[1] Juhl J,Crummy AB,Kuhlman J. (1998). Paul and Juhl's. Essentials of radiologic imaging. 7th ed. Philadelphia: Lippincott-Raven.
[2] Stamm AC, Draf W. (2000). Micro-edoscopic Surgery of the ParanasalSinuses and Skull Base. Berlin: Springer-Verlag.
[3] Alho O. (2004). Nasal Airflow, Mucociliary Clearance, and Sinus Functioning During Viral Colds: Effects of

Allergic Rhinitis and Susceptibility to Recurrent Sinusitis. Am J Rhinol. Vol. 18 (6), P: 349-55.
[4] Scadding G, Hellings P, Alobid I, Bachert C, Fokkens W, van Wijk RG, Gevaert P, Guilemany J, Kalogjera L, Lund V. (2011) Diagnostic Tools in Rhinology EAACI Position Paper. Clin Trans Allergy vol.1 (1), P: 2.
[5] Osguthorpe J D. (2001) Adult Rhinosinusitis: Diagnosis and Management. American family Physician, vol. 63, P: 13-47.
[6] Bhattacharyya N. (2006) Clinical and Symptom Criteria for the Accurate Diagnosis of Chronic Rhinosinusitis. The Laryngoscope. Vol. 116, P: 1-22.
[7] Cruz A. (2005). The 'united airways' require an holistic approach to management. Allergy vol. 60, P: 871-874.
[8] Timmanagouda P. (2008). Computed Tomography in the Evaluation of Pathological Lesions of Paranasal Sinuses. D Space at RGUHS University 14.139.159.4,
[9] Ologe FE, Olatunji A. A. (2003). Radiographic pattern of chronic sinusitis in Ilorin, Nigeria. Niger Postgraduate Med. J. vol. 10, P: 205-207.
[10] Srinivasa V. Elangovan S, Siva Subbarao P, Vineeth Abraham Anchery. (2013). Correlation of Rhinoscopy Findings With Nasal Endoscopy and CT scan Findings in Nasal Symptomatology. Journal of Evolution of Medical and Dental Sciences; vol 2, (51) P: 9948-9951.
[11] Maduforo C. O, Ibinaiye P, and Onotai L. (2013). Plain radiographic pattern of chronic sinusitis in Port Harcourt: our recent experience. International Journal of Medicine and Medical Sciences. Vol. 1, P: 317-320.
[12] Williams J, Simel D, Roberts L, & Samsa G. (1992). Clinical evaluation for sinusitis making the diagnosis by history and physical examination. Annals of internal medicine, vol.117**,** P: 705-710.
[13] Ruqqayia A, Abdul Q, Adil Q. (2011). Correlation of x rays and Computed Tomography in Paranasal Sinus Diseases. Pakistan Armed Forces Medical Journal (http://applications.emro.who.int/imemrf/Pak_Armed_Forces_Med_J/Pak_Armed_Forces_Med_J_2011_61_3_413_417.pdf).
[14] Chiu, P.Y, Chen, J, Chang C., Wei J, Chang C. (2010). The diagnostic Value of Sinus Radiography in the Evaluation of Sinusitis. Chinese Journal of Radiological Technology. Vol. 34, P: 143-148.
[15] Thiagarajan B. (2013). Role of x-rays in Rhinology. ENT Scholar, Vol. 2 Issue (1)
[16] Ahmad M, Khan M, Cheema K, Hameed A. (2000). Malignant tumors of Nose and Paranasal Sinuses. Ann KE Med Coll.vol 6, P: 169–170.

Author Profile

Abbas Omer Hussein Ahmed (Sudan) awarded the B.Sc. Degree in radiologic sciences from Sudan University of Science and Technology in 2003 and he has been working as supervisor of trainee student at Al-Ghad International Health Sciences Colleges-department of radiology- KSA

Ali Basheir Elhaj (Sudan) awarded the B. Sc. And M. Sc. in radiologic sciences from Sudan University of Science and Technology (2002 and 2006 respectively - SUST) and he has been working as lecturer at Al-Ghad International Health Sciences Colleges(Saudi Arabia) department of radiology.

Bushra H. Ahmed Abdelmalik (Sudan): awarded Professorship MD. Radiology SMAB - 2012, PhD in Medical Ultrasound-SUST 2006, MBBS Omdurman Islamic University-Sudan 2001, M.Sc. Science from Surrey University-UK 1983, Higher Diploma in Supplementary Physics from Surrey University-UK 1982, and Medical Ultrasound Diploma Middlesex School-UK 1981. He works as Dean of College of Medical Radiologic Science- SUST 1991-1995, Deanship of Faculty of Medicine National Ribat University-Sudan and as Major general (Police) Sudan.

Mohammed Ahmed A. Omer (Sudan): received the B. Sc. -1. in Radiotherapy and Nuclear Medicine, B. Sc.-2 in Medical Instrumentation Technology and M.Sc. degrees in Medical Physics from SUST in 1995, 1998 and 2001, respectively. He has been at RICK as well as a lecturer at College of Medical Radiologic Science-Sudan. He received a Ph. D. University Putra Malaysia-2007 in Medical physics-Applied Radiation, now as Associate Prof. at Qassim University-Buraidah-KSA.

Mohammed F. Mohammed Manafal: received B.Sc. in Anatomy and Physiology-Al Azhar University (Egypt) 1995, MSc. in Human Anatomy-Khartoum University (Sudan) 1998 and PhD in Medical Anatomy-Delhi University (India) 2004. He has been working as Teaching Assistant, Faculty of Medicine, Upper Nile University (UNU)-Sudan (1995-1997), Lecturer 1997-2004 and Assistant Professor up to 2006. Assistant Professor at Faculty of Medicine, Sudan International University (2006-2008) and Assistant Professor at College of Applied Medical Science, Qassim University, Kingdom of Saudi Arabia (2008-2011).