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Pulmonary Langerhans Cell Histiocytosis in a Male Teenager - A Case Report with Emphasis on HRCT Findings

By Joana Ruivo Rodrigues, Bernardete Rodrigues, Filipa Costa & Duarte Silva

Abstract- Pulmonary Langerhans cell histiocytosis (PLCH) is a rare pulmonary disorder with characteristic imaging features. It usually affects young adults and is associated with cigarette smoking. PLCH is listed in the gamut for cystic lung disease and should be considered by the radiologist if the appropriate findings are identified. The authors report an advanced case of PLCH in a young male with a smoking load of 6 pack-year. The prognosis is variable with frequent regression, stabilization, or recurrence of disease.

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Pulmonary Langerhans Cell Histiocytosis in a Male Teenager - A Case Report with Emphasis on HRCT Findings

Joana Ruivo Rodrigues ^α, Bernardete Rodrigues ^σ, Filipa Costa ^ρ & Duarte Silva ^ω

Abstract- Pulmonary Langerhans cell histiocytosis (PLCH) is a rare pulmonary disorder with characteristic imaging features. It usually affects young adults and is associated with cigarette smoking. PLCH is listed in the gamut for cystic lung disease and should be considered by the radiologist if the appropriate findings are identified. The authors report an advanced case of PLCH in a young male with a smoking load of 6 pack-year. The prognosis is variable with frequent regression, stabilization, or recurrence of disease.

I. INTRODUCTION

The lungs in Langerhans cell histiocytosis can be involved primarily or secondarily in any age group. Pulmonary Langerhans' cell histiocytosis (PLCH) is referent to the solitary lung involvement and is a rare cystic lung disease.

The focus of this article is the description of a rare case of a cystic pulmonary disease related to cigarette smoking, the PLCH. Radiographic and Computed Tomography findings of the patient are described and the most imaging features of this pathology are here highlighted.

II. CASE PRESENTATION

A 19 year-old man presented to the emergency department with a 1-month history of dyspnea after prolonged dry and non-productive coughing episodes. He had no thoracalgia or fever. At 18 years-old he had an episode of acute onset dyspnea and recurred to the emergency department in a peripheral hospital where he performed a chest radiograph with the diagnostic of spontaneous pneumothorax and any other diagnose. He did not take regular medications. He has worked in an aviary since his sixteen years and has a smoking load of 6 pack-year.

On physical examination, there were no signs of cyanosis, clubbing or lymphadenopathy. At physical examination vesicular breath sounds were present and no adventitious sounds were heard throughout both lungs.

The postero-anterior chest radiography done at arrival (Fig.1) revealed the presence of diffuse cystic changes throughout the upper and mid lung zone. A thoracic High Resolution Computed Tomography (HRCT) was suggested to further characterize these findings.

The HRCT demonstrated diffuse bilateral, bizarre shaped, coalescent and thin-walled cysts. The majority of them measured more than 1 cm in diameter and some of them were partially septated and confluent. The cysts had a predilection for the mid and upper zones and a regional sparing of the costophrenic recesses and lung bases (Fig. 2). In both lungs there were a few nodules, some of them with central cavitation and with irregular margins (Fig.3). No pneumothorax or pleural effusion were present.

Pulmonary function tests revealed mild mixed restriction and obstruction with discrete loss of diffusion capacity (DCLO=74%). Bronchoscopy revealed normal airways. A bronchoalveolar lavage (BAL) specimen was negative for microorganisms, the differential cell count revealed 68 % macrophages, 28% lymphocytes and CD4/CD8= 0,98. The Cluster of Differentiation 1a (CD1a) was positive. The α_1 -antitrypsin (A1AT) was negative, excluding the diagnosis of pan-lobular emphysema. The abdominal ultrasonography and the skeletal radiography didn't reveal any lesion.

The patient was diagnosed Pulmonary Langerhans cell histiocytosis taking into account the typical clinical history (initial episode of pneumothorax and progressive dyspnea with low DCLO); the typical imagiologic features (pulmonary bilateral diffuse bizarre cysts and nodules, sparing the costophrenic recesses and bases); and the positive immunohistochemical staining for CD1a surface antigen, specific for Langerhans cells. The cardiac thoracic surgeons team taking into account the extension of the cystic lesions and the operative risk chose not to perform the lung biopsy. Despite the patient was advised to stop smoking he continued to do it and his pulmonary function has been deteriorated considerably.

III. DISCUSSION

Langerhans cell histiocytosis is the most common primary histiocytic disease that affects the

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lung. The infiltration of specialized dendritic cells (Langerhans cells) can cause a single disease site (PLCH) or can involve multiple organs [1].

The Langerhans cells were described for the first time by Paul Langerhans in 1868, based on clinical observations [2]. These cells are usually within the airway mucosa and lung parenchyma and they increase in number with exposure to cigarette smoke. Smoking releases multiple chemokines, proteases, and enzymatic reactions, which produce damaging free radicals that destroy lung architecture leading to airway fibrosis [3]. The Langerhans cells can be identified by immunohistochemical staining for CD1a surface antigen or by the presence on electron microscopy of Birbeck granules [4]. The bronchiolar, interstitial, alveolar and vascular compartments of the lung are affected in PLCH. The varying degrees of interstitial inflammation, alveolar macrophage infiltration, and proliferative vasculopathy of both arteries and veins are caused by inflammatory bronchiolitis with loosely formed nodules of dendritic cells that are collected around small airways. Pathologic inspection shows nodules being replaced by advanced bullous and cystic lesions, often in association with hyperinflation and late-stage fibrosis with honeycombing [5].

PLCH can appear in all ethnic groups and can involve patients of all age groups, being most often diagnosed in patients between the ages of 20 and 40 years and being rare in children[5]. Women and men are equally affected[6]. The precise prevalence and incidence of LCH are unknown, however in a study which describe more than 500 patients with lung diseases and surgical lung biopsy the PLCH was diagnosed in 3.4% of the cases [7]. About 90% of patients have a smoking history; however the role of smoking in disease pathogenesis is incompletely understood [5].

Patients are asymptomatic in 25% of the cases when diagnosed of PLCH. In 2/3 the patients present with nonspecific symptoms like non-productive cough or dyspnea, and usually these symptoms have insidious onset and patients may attribute them to smoking. The disease can present for the first time with spontaneous pneumothorax in 10–20% of cases [6]. Pneumothorax tends to recur and may be bilateral. A minority of patients can have fever, weight loss and malaise [8].

On chest auscultation adventitious sounds are rarely present even in the presence of extensive radiological abnormalities. When advanced disease is present pulmonary hypertension and *cor pulmonale* can be seen [8].

The pulmonary function tests can show different patterns: obstructive, restrictive, or mixed. The carbon monoxide diffusing capacity (DCLO) is decreased in up to 90% of patients [9].

The radiographic appearance of PLCH is variable depending on the stage of disease, ranging

from small peribronchiolar nodular opacities to multiple irregularly-shaped cysts. Distribution of the lesions is the key for the differentiation of PLCH from other cystic lung diseases [10,11]. Differential diagnosis depends on whether nodular or cystic change is the dominant feature. In the early phase, when nodules are the dominant feature, it should be considered granulomatous diseases, metastases and miliary tuberculosis. In later phase, when cysts are prominent, it should be considered: lymphangiomyomatosis (LAM) (woman with diffuse distributed, regular shaped and sized cysts); cystic bronchiectasis; centrilobular emphysema; *Pneumocystis jiroveci* pneumonia; idiopathic pulmonary fibrosis (basal and subpleural distribution and reduced lung volumes); lymphocytic interstitial pneumonitis (LIP) [8-10].

The chest radiographic appearance usually is abnormal with bilateral and symmetrical, predominantly upper and mid-lung zone, nodules up to 1 cm in size, with irregular borders, usually sparing costophrenic angles and lung bases [8,10]. In the early stages of disease bilateral nodular and reticulonodular changes can be present. In the late stages, prominent cystic are dominant and nodules may regress[12]. In PLCH the lung volumes are preserved or increased [8,10]. Pneumothorax and pulmonary arterial hypertension are complications of PLCH[10].

High-resolution CT is the most sensitive imaging technic to show the spectrum of imaging features of PLCH, and these findings reflect the macroscopic appearance of the disease [10]. Brauner et al postulated the following sequence of abnormalities seen on CT scans: nodules, cavitory nodules, thick-walled cysts, thin-walled cysts, and confluent cysts [11]. The nodules are more pronounced early in the disease, may range in number from a few to innumerable, measuring typically 1-5 mm in diameter, with centrilobular distribution and irregular margins. They may cavitate and become cysts, which are more pronounced later in the disease. Cysts are surrounded by normal lung, measuring up to 2 cm and in late stage are thin-walled. The confluence of 2 or more cysts results in bizarre shapes cysts[10,11].

The inspection on bronchoscopy typically reveals normal airways, but bronchoalveolar lavage (BAL) specimens are usually cellular. The majority of the cells are alveolar macrophages, consistent with the fact that most patients are smokers. BAL cellular composition may demonstrate an increase in CD1a-positive cells, with 5% or greater considered highly supportive of the diagnosis [8].

Surgical biopsy is the main approach for the definitive diagnosis of PLCH, however it is an invasive procedure. Lung biopsy can generally be avoided when the HRCT findings are characteristic and concordant with the clinical history[8, 13]. CT findings of cysts and nodules in the middle and upper lung zones with

sparing of the lung bases are considered virtually diagnostic of PLCH[10].

About 50% of patients have clinical and radiographic stability, while up to 25% will demonstrate spontaneous regression[9]. Smoking cessation alone for most patients result in symptom stabilization [8,9]. Despite limited evidence of benefit corticosteroids are frequently used in the management of PLCH [8]. Lung transplantation is an option for patients with rapid deterioration of pulmonary function, although smoking cessation needs to be demonstrated to consider this option, as pulmonary LCH can recur if the patient continues to smoke. Pulmonary hypertension or respiratory failure are the main causes of mortality related with PLCH [9].

In conclusion, PLCH is a rare interstitial lung disease of unknown cause that primarily affects young adult cigarette smokers who typically present with cough, dyspnea, and mildly decreased diffusing capacity. High-resolution CT findings may be diagnostic of PLCH in the appropriate clinical setting, as shown in our case.

Conflict of interest

The authors wish to confirm that there are no known conflicts of interest associated with this publication and there has been no financial support for this work that could have influenced its outcome.

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FIGURES

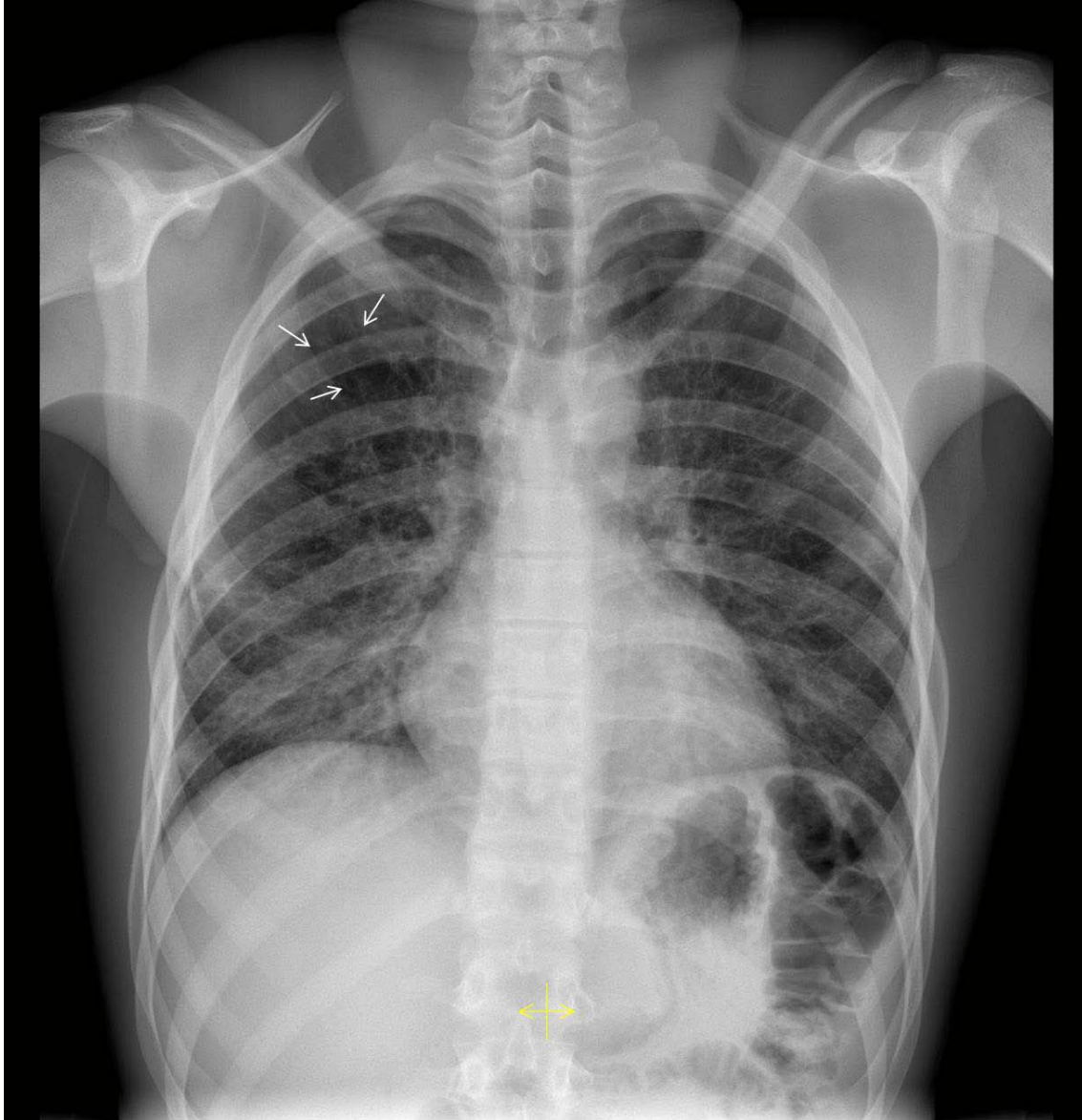


Figure 1: Chest radiography with postero-anterior incidence demonstrating cystic structures distributed diffusely in the upper and mid lung and more prominent on the right upper lung (arrows).



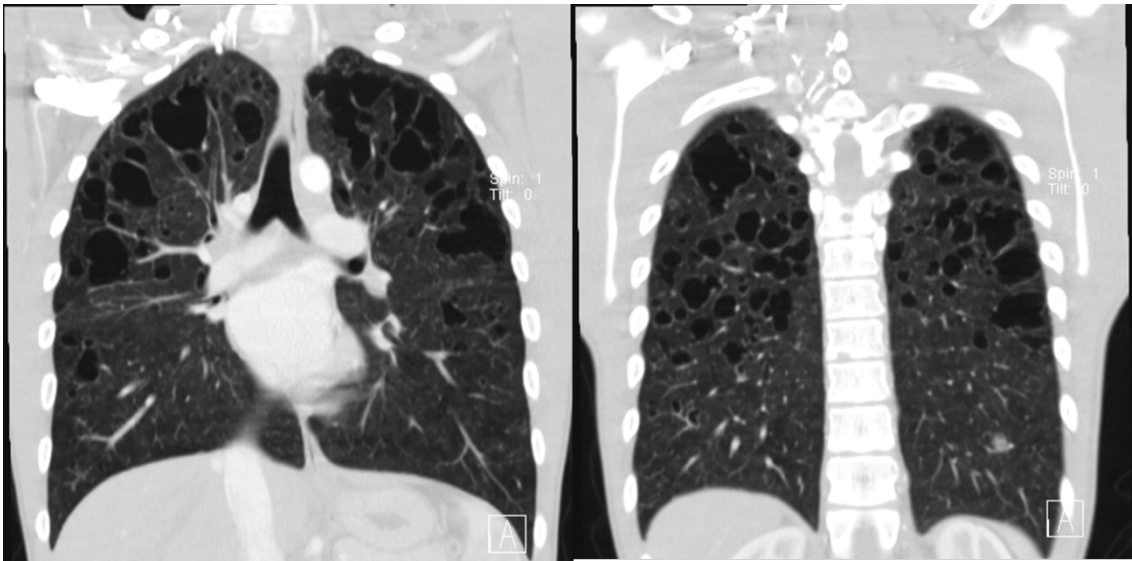


Figure 2: Coronal high-resolution CT images (lung window) showing diffuse lung cysts predominantly thin-walled, with bizarre shapes and various sizes, packed throughout the middle and upper lungs. There is relative sparing of the lung bases and costophrenic angles. Few nodules are also present.

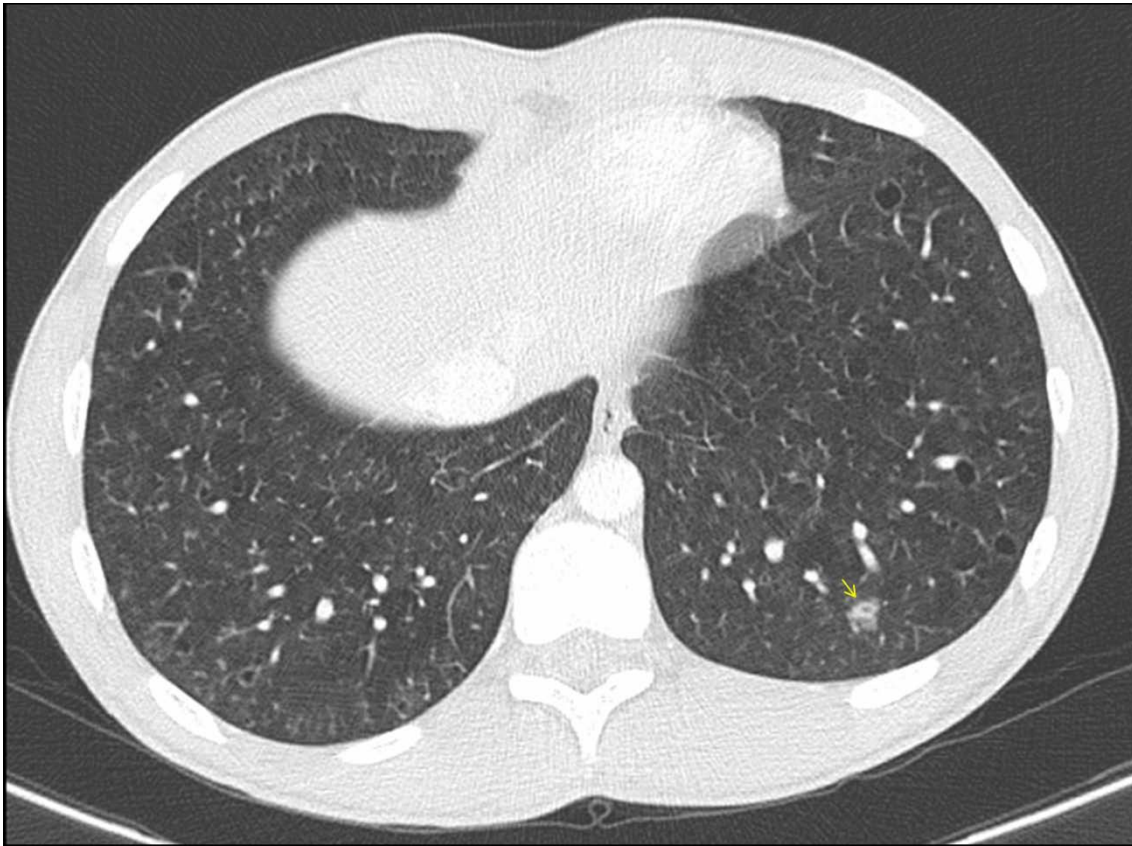


Figure 3: Axial high-resolution CT image (lung window) showing a solid peripheral nodule (arrow) with 13 mm, in the left lung base with irregular margins and central cavitation. The surrounding lung parenchyma appears normal.





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By Mbo Amvene J, Gwiswe Gnowe, Ekobena P. H, Neossi Guena M Ngaroua & Ibrahima Farikou

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Abstract- Aim: Dosimetry is a match between image quality and the low dose process in order to ensure the radiation protection of patients. The aim of this study was to evaluate the exposure of patients according to radiographic investigations at the radiology service of the Regional Hospital of Ngaoundere.

Methods: The prospective study involved adult patients with a mass of 70 ± 10 kg, during four months. Our data collected using a form adapted according to the model of the Institute of Radioprotection and Nuclear Safety (IRSN) of dosimetric evaluation in classical radiography were compared with the referential of this institution. The analysis and the processing of the data of each radiographic exploration made it possible to estimate the entrance dose of skin (De) and to compare with those obtained by the same indirect approach and with the DRLs available.

Results: 100 patients were involved in our study. The doses at the entrance of the skin obtained in mGy were respectively 7.57 ± 2.1 and 9.52 ± 0.9 for the face and profile of the skull, 8.77 ± 0.9 for the face/profile incidences of the cervical spine, 6.75 ± 0.3 and 8.13 ± 0.3 for thoracic spine, 9.65 ± 1.5 and ± 1.5 for the frontal and profile incidences of the lumbar spine.

Keywords: *standard radiography, entrance dose, radioprotection, diagnostic reference level (DRL).*

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Conclusion: Although the radiological images remain interpretable; the elements, such as the technical absence of protocol, the inadequate profile of certain personnel, associated the inexistence of the texts in favour of the practices of protection against radiation, in spite of a permanent alternation of the trainees in radiology were identified like supporting an over-exposure of the patients to the ionizing radiations.

Keywords: *standard radiography, entrance dose, radioprotection, diagnostic reference level (DRL).*

I. INTRODUCTION

The irradiation related to the acts of radiodiagnosis constitutes the principal artificial source of ionizing radiations to which the man is exposed in hospital medium. The determination of the amounts delivered with the patients is like an adequacy of the quality of the image and the process of optimization of the radiations. The optimization of the amounts delivered during the radiological examinations, by the determination of the

Levels of Diagnostic Reference (NRD) and its quality control of the installations and radiological procedure, make it possible to minimize the risk related to these irradiations by reducing the amount received by the patient [1] (Monnehan and *Al*, 2009).

The protection against radiation of the patients in radiodiagnosis is controlled by the principles of justification, optimization and limitation, including the consideration of the Levels of Diagnostic Reference NRD [2] (Gholami and *Al*, 2015). The three great principles of protection against radiation enacted by directive 96/29 Euratom are the justification of the exposures, their optimization and the limitation of the amounts [3] (Michel Bourguignon). Of these principles it should be noted that the justification of an act rests on the decision which awaited information is necessary to the orientation of the diagnostic strategy, it is to say that the benefit of the irradiant act, must be higher than that of another technique not or less irradiant. Optimization as for it consists in carrying out the examination which was decided at the best dosimetric cost without however reducing the quality of information necessary to the diagnosis. So the optimal realization should be in conformity with principle ALARA, *Have Low Have Reasonably Achievable*, and the delivered amounts confronted regularly at the diagnostic levels of reference. Taking into account individual specificities, the limitation of amount delivered with the patient remains a constant concern but it does not have there lawful limit of amount to the patient as for the workers, the limitation of amount remains not easily applicable and from where its substitution for the diagnostic levels of references (NRD).

However, the linear relation without threshold is the ultimate justification and protection against radiation concerning the irradiations of low dose bases, i.e. the radiations delivered by acts of radiodiagnosis. Indeed, the effects for health with these amounts are not only low, but zero below a precise threshold which would remain to be defined [4] (Barrington and *Al*, 2004). These variations indicate that the good technique of imagery is necessary to reduce the amount to the patients to low the practicable level making it possible to

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answer the private clinic and to pose the diagnosis [5] (Dlama and *Al*, 2014). Indeed, the amounts delivered with the patients at the time of the procedures of the acts of radiodiagnosis are not sufficiently controlled and the protocols of work for a given examination differ from a ward with another. Pursuant to the principle of optimization and without calling into question the diagnostic quality of the examination, the dosimetry of the patients remains function of the operational parameters the such high voltage or kilovoltage (Kv), the intensity of the current or milliamperere which is a function of time (farmhouse), the morphotype, the incidence, Distance-Hearth-Skin (DFP), Distance-Hearth-Film (DFF).

In radiology, it should be noted that the diagnosis is depend on the quality of the radiological image consequently of the amount on the surface of entry of the skin. The concept of diagnostic level of reference (NRD) is specific to the medical exposures and does not have to be confused with that of "limit of the personal doses" which is applied in the fields of the protection against radiation of the workers and the public. The use of the ionizing radiations at diagnostic or therapeutic ends is indeed incompatible with a lawful limitation of the amounts. The level of irradiation is subordinated to the medical objective. It is to say, to impose "a priori" insuperable thresholds would be a misinterpretation prejudicial with the patients [6] (Beauvais and *Al*, 2004). The Levels of Diagnostic Reference (NRD) correspond to the 75ème percentile, 75% of the individuals receive amounts lower than this value [7] (Olowookere and *Al*, 2012). The NRD are indicators of the quality of the practices making it possible each one to locate its practice compared to the whole of the profession and to correct possible variations.

The NRD are tributary and depend for the majority of the delivered amount, the quality of the equipment, the level of knowledge of the manipulators, and constitute powerful and efficient tools for the optimization of the amount. As observed elsewhere, great variations of the amounts delivered with the patients for the same examination show a cardinal importance for the study of the variations of the amounts [8] (Gray and *Al*, 1999). The useful dosimetric sizes for the evaluation of the delivered amount are the amount at the entry (Of) and the Product Amount- Surface (PDS) [9] (Cordoliani and *Al*, 2002). The amount at the entry of the skin (Of) in conventional radiography can be obtained by calculation starting from the mathematical methods or be measured by a thermoluminescent dosimeter (TLD) [7] (Olowookere and *Al*, 2012). Several approaches (direct or indirect) make it possible to measure the amount at the entry of the skin. Direct approach where the amount at the entry of the skin of

the patient is made using a thermoluminescent dosimeter (TLD) as deferred in the literature [10] (Nyathi and *Al*, 2009; [11] Egbe and *Al*, 2009; [12] Ogundare and *Al*, 2004). The indirect approach makes it possible to evaluate the amount at the entry of the skin starting from the parameters of exposure (Kv, farmhouse, and DFP) formulated in the semi-empirical model. In a world becoming of more demanding and especially by the search of excellence as regards medical imagery and/or radiotherapy, the knowledge of the amount delivered with the skin, should take all its importance in our context through the technical parameters of realization of a standard radiography in neuroradiology and for a better protection against radiation of the subject.

➤ *General Objective*

To evaluate the amount at the entry of the skin in the adults during standard radiography in neuroradiology.

➤ *Specific Objectives*

- To arise the profile of the technical parameters used;
- To determine the amount of entry to the skin of the subjects using the empirical tool by the method of Davies;
- To compare this amount of entry with the skin at the diagnostic levels of reference, (NRD).

II. MATERIALS AND METHOD

It was about a monocentric, descriptive and transverse study, which proceeded between April and July 2016, in the service of radiology and medical imagery of the Regional Hospital of Ngaoundéré.

Were included in this study, all the subjects without reference to sex nor of age having undergone an examination of standard radiodiagnosis of neuroradiology for the aforementioned period. The data collected comprised the age, the sex, the anthropometric data of the patients with weights ranging between 70 ± 10 kg as well as the technical parameters used (Kv, farmhouse, DFF, DFP), on two X-ray emitting tubes of mark GENERAL ELECTRIC model 5192454 whose maximum tension at the boundaries was around 150 Kv.

The parameters of irradiation intervening in the calculation of the amount at the entry of the skin were the subject of a calculation of averages, 75 èmes percentiles of standard deviations. The calculation of the amount at the entry of the skin consisted in calculating the power, the output (output) of the tube with x-ray [13] (Suchart and Montree, 2011) using parameters of irradiation directly implied in the realization of the examinations with;

$$O/P(Mr.) = A \times 6.53 \times 10^{-4} (mR/mAs)(kVp2)^{-1} \times kVp2 \times farmhouse \quad (1)$$

where A a constant equalizes of 0,5;0,8 and 1 for the generator single-phase currents tubes, three-phase and high frequency. Within our framework of study, the tube with x-ray was three-phase. The outputs obtained were converted of (Mr.) in (mGy. farmhouse-1) by multiplication with a factor of 0,00877/mAs [14] (Faulkner et al., 1999). The amount at the entry of the skin for each patient was calculated by using the parameters of irradiation of each radiographic exploration according to the model of Davies [15] (Olowookere and A/, 2009).

$$D_e(\text{mGy}) = (O/P) \left(\frac{kV}{80}\right)^2 \text{mAs} \left(\frac{100}{DFP}\right)^2 \text{BSF} \quad (2)$$

The data analysis and processing of the 75 èmes percentiles of the parameters of irradiation as well as the calculation of amount at the entry of the skin (Of) of the patients were carried out by Excel 2010.

The data were collected, processed and analyzed by keeping the most strict anonymity. The data processing was carried out using the software Sphinx Plus² V.5.1.0.6.

Only the images of good qualities having been used for the diagnosis were considered.

The study was authorized by the ethics committee of the aforementioned hospital structure.

Conflict of interest: None

III. RESULTS

Table 1: Sociodemographic Characteristics

Radiography	Sex	Amount	Age (year)	Weight (kg)
			Min -Max	Min -Max
Cranium (head)	M	14	21-49 (32,57 ± 7,48)	62-78 (69,64 ± 4,93)
	F	11	21-44 (32,90 ± 7,10)	65-78 (71,36 ± 4,39)
Cervical Rachis	M	17	26-52 (37,83 ± 8,34)	62-79 (69,66 ± 5,51)
	F	7	24-55 (37,85 ± 9,49)	63-79 (71,57 ± 5,82)
Dorsal Rachis	M	18	28-56 (41,61 ± 8,13)	64-80 (70,38 ± 5,17)
	F	7	30-55 (42,85 ± 7,95)	67-76 (71,14 ± 2,69)
lomber Rachis	M	12	29-55 (43,41 ± 8,63)	63-78 (69,16 ± 3,67)
	F	14	35-54 (44,5 ± 6,13)	68-80 (75,78 ± 2,88)

- For a total of 100 subjects, the men were represented than the women is 61%, for a sex ratio (H/F=1,56).

Being the male sex

- The average age of the men was 32,57 and the standard deviation was 7,48 years, the age bracket lay between 21-49 years for cranium;
- The average age was 37,83 and the standard deviation was 8,34 years, the age bracket lay between 26-52 years for the cervical rachis;
- The average age was 41,61 and the standard deviation was 8,13 years, the age bracket lay between 28-56 years for the dorsal rachis;

- The average age was 43,41 and the standard deviation was 8,63 years, the age bracket lay between 29-55 years for the lumbar rachis.

Being the female sex

- The average age of the women was 32,90 and the standard deviation was 7,10 years, the age bracket lay between 21-44 years for cranium;
- The average age was 37,85 and the standard deviation was 9,49 years, the age bracket lay between 24-55 years for the cervical rachis;
- The average age was 42,85 and the standard deviation was 7,95 years, the age bracket lay between 30-55 years for the dorsal rachis;

- The average age was 44,5 and the standard deviation was 6,13 years, the age bracket lay between 35-54 years for the lumbar rachis.

Table 2: Output of the tube in **mR** and **mGy. (mAs)⁻¹**

Radiography	Incidence	Output (mR)		Output mGy. (mAs) ⁻¹	
		Min	Max	Min	Max
Cranium (head)	F	22,07	25,59	0,19	0,22
	P	22,08	29,38	0,19	0,25
Cervical Rachis	AP/P	21,39	29,38	0,18	0,25
Dorsal Rachis	AP	22,07	29,38	0,19	0,25
	P	22,07	9,38	0,19	0,25
lombarrachis	AP	22,07	29,38	0,19	0,25
	P	25,59	33,43	0,22	0,29

These values constitute essential parameters in the process of optimization of the delivered amount and the quality of the stereotypes. They are directly a function of the high voltage (Kv) and the load (farmhouse).

- **For cranium**, in mGy.(mAs)⁻¹, output went from 0,19 to 0,22 from face and 0,19 to 0,25 of Profile;

- **For the cervical rachis**, in mGy.(mAs)⁻¹, output went from 0,18 to 0,25 in AP that out of P;
- **For the dorsal rachis**, in mGy.(mAs)⁻¹, output went from 0,19 to 0,22 in AP that out of P;
- **For the lumbar rachis**, in mGy.(mAs)⁻¹, output went from 0,19 to 0,25 in AP and 0,22 to 0,29 of Profile.

Table 3: Technical Parameters Used

Radiography	Incidence	kV	mAs	DFF	DFP	De		3 ^{ème} quartile	SD
						Min	Max		
Crânium	F	65-70 (63,3 ± 3,6)	50-64 (54,2±2,5)	1,1-1,4 (1,1 ± 0,00)	1,3-1,6 (1,49±0,09)	7,5	9,0	7,57	2,1
	P	65-75 (66,7 ± 2,1)	50-65 (55,8±1,9)	1,1-1,4 (1,1 ± 0,00)	1,3-1,6 (1,49±0,09)	9,7	10,4	9,52	0,9
Cervical rachis	AP/P	64-75 (69,5±3,2)	32-40 (35,9±3,8)	1,0-1,2 (1,0±0,05)	1,2-1,5 (1,31±0,10)	5,3	8,7	8,77	0,9
Dorsal rachis	AP	65-75 (67±2,1)	40-60 (46,7±3,7)	1,0-1,4 (1,2±0,06)	1,4-1,7 (1,53±0,07)	7,2	9,6	6,75	0,3
	P	65-75 (70,2±1,0)	45-60 (49±1,9)	1,0-1,4 (1,2±0,06)	1,4-1,7 (1,53±0,07)	8,1	10,4	8,13	0,3
Lombarrachis	AP	65-75 (67,1 ± 2,4)	50-65 (55,9±4,2)	1,0-1,4 (1,1 ± 0,10)	1,3-1,7 (1,49 ± 0,09)	9,0	10,4	9,65	1,5
	P	70-80 (74,5 ± 2,77)	60-65 (60,4 ± 1,2)	1,0-1,4 (1,1 ± 0,10)	1,3-1,7 (1,49 ± 0,09)	13,7	14,5	15,77	1,5

kV : kilovolt ; mAs : milliampère seconde ; DFF: Distance-Foyer-Film; DFP: Distance-Film Peau; De: Dose à l'entrée; SD: Standard Déviation

For cranium, and in mGy, the third quartile was 7,57, the standard deviation was 2,1 and the amount minimum and maximum at the entry of the skin varied between 7,5 and 9,0 in AP;the third quartile was 9,52, the standard deviation was 0,9 and the amount minimum and maximum at the entry of the skin went from 9,7 to 10,4 of Profile.

- **For the cervical rachis**, and in mGy, the third quartile varied between 8,77, the standard deviation was 0,9 and the amount minimum and maximum at the entry of the skin varied between 5,3 to 8,4 in AP in AP that out of P.
- **For the dorsal rachis**, and in mGy, the third quartile varied between 6,75, the standard deviation was 0,3

and the amount minimum and maximum at the entry of the skin varied between 7,2 to 9,6 in AP; the third quartile was 8,13, the standard deviation was 0,3 and the amount minimum and maximum at the entry of the skin varied between 8,1 to 10,4 of Profile.>.>.

- **For the lumbar rachis**, and in mGy, the third quartile varied between 9,65, the standard deviation was 1,5

and the amount minimum and maximum at the entry of the skin varied between 9,0 to 10,4 in AP; the third quartile was 15,77, the standard deviation was 1,55 and the amount minimum and maximum at the entry of the skin varied between 13,7 to 14,5 of Profile.

Table 4: Comparison between our values and certain referential values

De (mGy)						
Radiography	Incidence	Notre étude	NRD	Soudan 2016	Iran 2016	Iran 2015
			Européen	Abu Khair et al.[16]	Khoshdel-Navi et al.[17]	Gholami et al.[2]
Crânium (head)	F	7,57 ± 2,1	3	1,9 ± 0,164	3,05 ± 0,98	3,48 ± 2,87
	P	9,52 ± 0,9	5	1,2 ± 0,193	1,42 ± 0,79	2,73 ± 1,34
Cervical rachis	AP/P	8,77 ± 0,9	4	1,35 ± 0,267	1,07 ± 0,38	2,13 ± 1,80
	-	-	-	1,67 ± 1,130	1,17 ± 0,37	1,53 ± 1,06
Dorsal rachis	AP	6,75 ± 0,3	5	-	3,1 ± 0,73	12,47 ± 8,69
	P	8,13 ± 0,3	7	-	4,61 ± 3,14	3,73 ± 0,82
Lombar rachis	AP	9,65 ± 1,5	10	4,9 ± 0,625	3,55 ± 0,82	9,57 ± 8,73
	P	15,77 ± 1,5	25	18,5 ± 1,661	4,69 ± 0,78	18,99 ± 23,89

The values obtained were compared with the referential values and those obtained elsewhere for the same approaches.

- **For cranium**, in mGy, the amount at the entry of the skin was of 7,57 ± 2,1 of face and 9,52 ± 0,9 of Profile.
- **For the cervical rachis**, in mGy, the amount at the entry of the skin was of 8,77 ± 0,9 in AP that out of P.
- **For the dorsal rachis**, in mGy, the amount at the entry of the skin was of 6,75 ± 0,3 AP and 8,13 ± 0,3 of Profile.
- **For the lumbar rachis**, in mGy, the amount at the entry of the skin was of 9,65 ± 1,5 AP and 15,77 ± 1,5 of Profile.

IV. DISCUSSION

In standard neuroradiology, the knowledge of the amount of entry to the skin becomes more and more a need in a more demanding world but also in perpetual change. The standard examinations of neuroradiology occupy the daily newspaper of radiographies after the exploration of the thorax. The good radiographic practice implies of this fact a permanent adaptation of the technical procedure related on the sociodemographic data, the equipment and the choice of the parameters (irradiation and geometry) which constantly influence the amount received by the patient and in bond with the irradiation and the geometry of the beam of X-radiation.

The contribution of the sociodemographic data of the patients remains paramount, for the good

technical realization. Indeed, the age of the patient is a significant parameter in the choice of the technical parameters and the interpretation of the examinations carried out as well as the means of protection against radiation. In that, our results approach those of Moifo (Moifo and A/, 2014) [18]. Indeed, one is brought more and more to work in the conformity of the bulletins of examination by laying a stress in his good filling and while insisting on the administrative elements [18], in particular the name and the age with their corollary in context, the school level and the problems involved in the communication, all things which can resound on the absence of conformity in the filling of bulletins of examinations.

Moreover, the protection against radiation of the patients through the evaluation in dosimetric term in a structure located at the heart of the medical activities of the area of Adamaoua. These results cannot be extrapolated with the whole of the radiological services Camerounais insofar as the participation in the dosimetric study of this service were based on principle of voluntariate. Nevertheless, they constitute actual values and indicative because they relate to the standardized procedures carried out on patients of morphotypes well defined (mass ranging between 60 and 80 kg). The calculation of the average sizes dependent on (mGy) starting from the 75 ème percentile has as a principal objective to illustrate a determination of the NRD by an indirect approach in order to indicate existing margins between the values suggested like referential and those estimated elsewhere by the same approach. However, in spite of the existence of a law



framing protection against radiation and an agency in main road of protection against radiation [19] (Ongolo-Zogo and *Al*, 2011), the absence of the technical protocols in the room of examination makes difficult the maitrise of the amounts delivered to the patients. As observed elsewhere, the absence of the texts in favour of protection against radiation and or extracted in this service from radiology proves the embryonic state of the protection against radiation of the patients in this service of radiology. In practice, while posting and by applying the latter, it is possible to avoid an useless irradiation in spite of the routine frequentation of the trainees in radiology obliged to carry out stereotypes of good quality without any indicative knowledge of the properties of the X-ray emitting tube. This report is still very alarming, when radiographies are carried out with the daily newspaper by some assistance-looking after which do not have any profile "background" of the field but rather converted into manipulators in radiology. The latter do not have then is any idea or then an approximate knowledge of the texts in favour of protection against radiation. These observations bring to note that contrary to the developed countries, in the countries of sub-Saharan Africa, in particular at Cameroun the legislative and regulatory executives either non-existent or are implemented in an approximate way and the practices of the protection against radiation of the patients are documented little [19] (Ongolo-Zogo and *Al*, 2011) in a context of expansion of the medical imagery. If the report is real through this study, it is advisable to raise the embryonic and precarious state of the standards and devices in favour of the protection against radiation of the patients in the process of optimization of the amount received by the latter during examinations of radiodiagnoses. Much more, it is advisable to retain that at the time when the imagery extends in the zones most moved back from the country, it is urgent to optimize the protocols of work. This optimization of the protocols could be carried out by the formation continues, posting in the rooms of examinations of the protocols of work and a permanent comparison of the values to the references and measurements of permanent correction could partly reduce the variations observed. However, the reduction of the amounts delivered with the patients could be effective well by the setting places of a lawful framework with obligation of designation and of qualified training of people in protection against radiation (PCR) which would not only make it possible to improve protection against radiation of the patients but also of the personnel, equipping more than the console of handling offers a platform of adjustment of the parameters of irradiation and dosimetric controls.

Conformity with the reference frames and values besides

Table 4 draws up a comparative state between the results obtained, the reference frames (NRD) and

the values estimated elsewhere. This table indicates that the values obtained are well above the standards referential and higher than those estimated elsewhere by the same method. These variations were in a specific way associated the going beyond of the face values as suggested by the manufacturer in spite of the absence of protocols.

The radiographic resumption of the examinations is a significant avoidable or at least reducible factor of over-exposure of the patients. It is necessary to consider measurements of efficient correction and reduction such as the periodic evaluation and the control of the dosimetric values.

V. CONCLUSION

This evaluation study according the dosimetric term of the procedures of the acts of radiodiagnosis of the neurological system. However, the analysis relating to the posting of the protocols of work in the rooms of examinations in particular to the service of radiology of the regional hospital of Ngaoundéré associated with the reinforcement with competences (formation continues and recycling) as regards protection against radiation remains very alarming in a context where this discipline is practised more and more by personnel not having any knowledge of the ionizing radiations. In radiology, the dosimetry of the patients is like an adequacy between the quality of the image and the process at low dose. The permanent evaluation with the periodic means of controls and the professional practices, the fight for the reduction of the delivered amounts should be in the center of the daily activities of the structure in load through effective follow-ups on the ground and in all the structures equipped with the tubes with x-ray.

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Investigation of the Effect of Coating Method on the Radiation Shielding Properties of Terry Cotton Fabric

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Abstract- There is an increasing attention addressing the compliance with sanitary regulations all over the medical institutions. Consequently emerged along with a parallel interest over the medical gowns, as being a side branch of medical textiles. Medical gowns are the most important item among the surgical garments. Terry cotton fabric is a kind of fabric used especially for medical hospital clothes. Terry cotton fabrics are two varieties; 63% cotton, 37% polyester and 50% cotton, 50% polyester.

In this study, terry cotton fabrics were used for coating method processing; fabrics also were covered in the single and double face. Barite is penetrated into the terry cotton fabric with coating methods by using barite at different rates. According to data obtained the most appropriate covering method, barite type was determined. The effect of radiation exposure on the coating type was investigated. The results of the experiments showed that barite impregnation significantly increases the radiation absorption capability of the fabric. It was found that the radiation absorption capability of the coated fabric was higher than that of the impregnated fabric.

Keywords: *terry cotton fabric, radiation shielding, barite, coating.*

GJMR-D Classification: *NLMC Code: WB 288*



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Investigation of the Effect of Coating Method on the Radiation Shielding Properties of Terry Cotton Fabric

Şemsettin Kiliñarşlan ^α, İskender Akkurt ^σ, Serkan Üncü ^ρ & Feyza Akarşlan ^ω

Abstract- There is an increasing attention addressing the compliance with sanitary regulations all over the medical institutions. Consequently emerged along with a parallel interest over the medical gowns, as being a side branch of medical textiles. Medical gowns are the most important item among the surgical garments. Terry cotton fabric is a kind of fabric used especially for medical hospital clothes. Terry cotton fabrics are two varieties; 63% cotton, 37% polyester and 50% cotton, 50% polyester.

In this study, terry cotton fabrics were used for coating method processing; fabrics also were covered in the single and double face. Barite is penetrated into the terry cotton fabric with coating methods by using barite at different rates. According to data obtained the most appropriate covering method, barite type was determined. The effect of radiation exposure on the coating type was investigated. The results of the experiments showed that barite impregnation significantly increases the radiation absorption capability of the fabric. It was found that the radiation absorption capability of the coated fabric was higher than that of the impregnated fabric.

Keywords: terry cotton fabric, radiation shielding, barite, coating.

I. INTRODUCTION

Radiation is a phenomenon which is readily available in nature and our daily lives [1]. The use of radiation for various purposes has become widespread in modern societies. It puts at biological risk to all living things [2]. Today radiation is used for different purposes in basic science, medicine, agriculture, industry and military field [3].

Obtained radiations from various radioisotopes are used in many branches of physics, chemistry, and biology. Nowadays, increasing number of nuclear power plants should have been taking preventive measures against harmful rays by considering the increase in radiation emitting devices [4-5].

In fields such as medicine, scientific research, agriculture and industry, many live things exposed to radiation rays for treatment and meeting the needs. It is extremely important to protect these radioactive rays,

which are countless harms to the human body [6]. People working in such areas need to wear armor clothes to keep their health. Nowadays, shielding clothes are very heavy because they are produced from lead plates in general, and they are not preferred because they are hard regarding using. Although lead is a very good radiation shielding, it gives great harm to human health. For this reason, humanity has been directed to alternative phenomena that have the feature of radiation shielding and do not harm health [7]. Barite (BaSO_4) is the most known barium mineral with radiation shielding properties [8]. It is white, opaque or semi-transparent. Bleached barite together with sulfuric acid is used as the emitter in the production of white lead paint due to its weight. The grain size of barite is very important. Barite has a feature that makes gamma rays harmless. For this reason, barite is used in a hospital. In addition to these features, barite has other positive features. However, in this study, X-ray retention of barite and radiation protection properties are emphasized.

The desired properties can be added to ordinary fabrics by using the coating method in fabrics [9]. The main purpose of the coating process is to coat each region of the fabric in equal amounts [10]. The main purpose of this study is to obtain barite-coated terry cotton fabric and investigate radiation shielding properties of this fabric.

For this basic purpose, it is possible to divide the studies made into subgroups as follows.

- Producing barite-coated fabric by penetrating barite on terry cotton fabric.
- Obtaining of Radiation processing coefficient of the obtained fabrics (RPC).
- Evaluation of the obtained results.

II. MATERIALS AND METHOD

The purpose of this study is to analyze the effects of coating type on the radiation absorption properties of terry cotton fabric.

a) Terry Cotton Fabric

The reason behind the focus on terry cotton fabric in this project is that it is fabric commonly used in a lab coat and lab apparel production. Terry cotton fabric is a plain weave fabric consisting of a mixture of

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polyester and viscose. Features of terry cotton fabric are given in Table 1.

Table 1: Features of Terry Cotton Fabric

Terry Cotton Fabric Features	Frequency (per/cm)	Yarn Number (Nm)	Knitted Report	C ₁ (curl ratio)	Fiber Type	Weight (g/m ²)
Weft	38	60		%7,5	PES	172
Warp	110	100		%4,3	Viscose+PES	

b) Preparation of Barite Coatings

Terry cotton fabric samples were produced by impregnation and coating method. In the impregnation method, the solution prepared between 2 bar pressure cylinders was poured, and the fabric sample was processed by the foulard process. The case of coating application, barites, and coating chemicals were added to the mixtures prepared for use at different ratios. The template prepared for use in the cover is stretched in different permeable fabrics such as a gas cloth, a tulle or silk, and then the application is carried out. The coating is applied to single and double surfaces of fabrics. In this way, it has been tried to produce fabrics with optimum properties by producing samples with different properties.

c) Image Processing Experiment

Digital X-ray films of specimens shot by penetration of barite with coating and impregnation method were taken under the supervision of special radiologists in Meddem Hospital. Obtained X-ray film images were processed using Matlab program. In X-ray films belonging to fabrics, parts were taken from three different points. Obtained images are digitized by the Matlab program. Obtained images are 8-bit images in Grayscale, and the images can only have a color value between 0-255. 0 is the black color, 255 is the white color. The fact that it is close to 0 value means that it can not hold the X-ray, it is close to the value 255 it shows that it holds the X-ray [11,12].

The Radiation Image Processing Numerical Value (RIPNV) is calculated by the program. For the RIPNV to be independent of the selected area, this value is divided into the image area calculated by the program and Radiation Processing Coefficient (RPC) is obtained.

d) Radiation Shielding Experiments

Radiation shielding experiments of the prepared fabrics were carried out in the Gama Spectroscopy Laboratory of the Department of Physics.

The linear absorption coefficient (μ) is calculated by the following equation [13].

$$I = I_0 e^{-\mu x} \quad (1)$$

I_0 radiation intensity before interaction with substance,
 I radiation intensity after interaction with substance,
 x the thickness of the material,
 μ linear absorption coefficient

III. RESULTS AND DISCUSSION

a) Result of Images Processing Experiment

Digital images are used to calculate radiation image processing numerical values (RIPNV) using software developed concerning the histogram method, and then radiation shielding image processing coefficient (RPC) was obtained. Table 2 shows the RIPNV and RPC values obtained from terry cotton fabric which was not treated.

Table 2: RIPNV and RPC Values Obtained from Untreated Terry Cotton Fabric

RIPNV (1)	RIPNV (2)	RIPNV (3)	RIPNV Mean	RPC
0,74	0,77	0,71	0,74	0,0091

Comparison Graphic of RPC of terry cotton fabrics is given Figure 1.

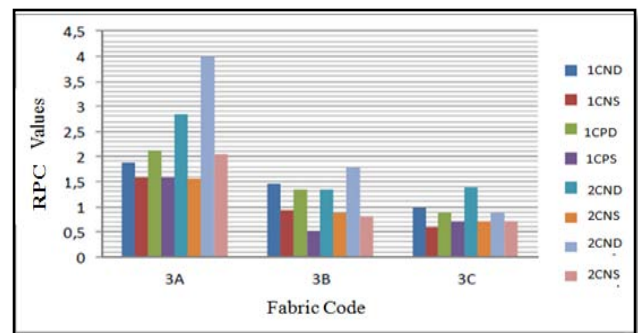


Fig. 1: Comparison Graphic of RPC of Terry Cotton Fabrics

RPNV and RPC value result for the impregnated terry cotton fabrics is given Figure 2.

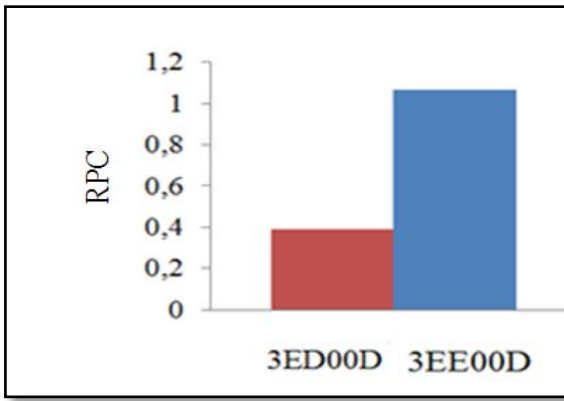


Fig. 2: RIPNV and RPC Value Results for the Impregnated Terry Cotton Fabrics

b) Results of Radiation Shielding Experiment

Radiation absorption coefficient of untreated terry cotton fabrics is given Table 3.

Table 3: Radiation Absorption Coefficient of Untreated Terry Cotton Fabrics

μ (cm ⁻¹) 662 keV	μ (cm ⁻¹) 1173 keV	μ (cm ⁻¹) 1332 keV
0,2413	0,1880	0,1596

Radiation absorption coefficient of barite-coated terry cotton fabric is given Figure 3.

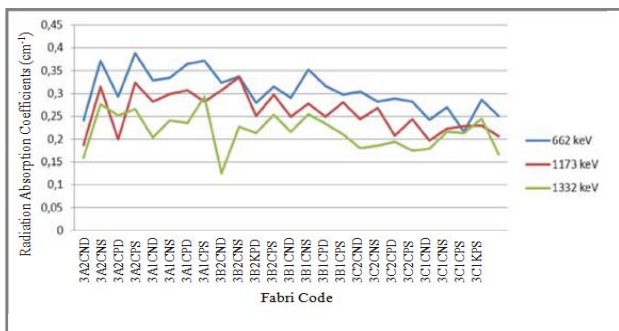


Fig. 3: Radiation Absorption Coefficient of Barite-coated Terry Cotton Fabric

IV. CONCLUSION

The methods used ensured barite-impregnated/coated fabric production as a result of barite penetration into terry cotton fabric.

- ✓ The results of the experiments showed that barite impregnation significantly increases the radiation absorption capability of the fabric.
- ✓ It was found that the radiation absorption capability of the coated fabric was higher than that of the impregnated fabric.
- ✓ It was observed that increased barite ratio also improves radiation shielding properties.

- ✓ It was also found that double-sided coating increases radiation shielding properties when compared to single-sided coating.
- ✓ An agreement between the experimental values and the values obtained using image processing method was found.
- ✓ It was concluded that the barite coated fabric used in this study could be utilized in the production of lab coats and other protective apparels for that personnel who are exposed to radioactive settings.

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A Comparative Analysis of Factors Influencing Compliance to Contain Man-Made Ionizing Radiation in Diagnostic Medical Imaging Devices

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Abstract- The unnatural ionizing radiation emanated from Medical Diagnostic Imaging devices particular, CT and X-ray Scanners, contributes more than 50 percent of exposure to radiation globally. The technicians felt the need for deploying new technological equipment use as they consume considerably less dose for diagnosis. Hence, the management of hospitals and diagnostic centers is considering the need for swift adoption of modern and highly innovative equipments for improving patient safety and operational effectiveness. India being a country which encourages refurbished and new medical diagnostic imaging equipment, compliance with regulatory requirements for containing excessive radiation becomes critical. This research study has analyzed regulatory compliance in hospitals and diagnostic centers with 451 samples across the southern part of Tamil Nadu, India. There were seven different dependent variables namely Regulatory, Layout Engineering, Technician Competency, Human Safety, Operations Know-How, Radiation Exposure Monitoring & Top Management Commitment were studied using a structured questionnaire, and Kruskal-Wallis test was performed to compare the radiation compliance score.

Keywords: *ionizing radiation, computed tomography, digital radiography, regulatory compliance, exposure to radiation & man-made radiation.*

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R. Rajan ^α & Dr. Sheela Suganthi ^ο

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Keywords: ionizing radiation, computed tomography, digital radiography, regulatory compliance, exposure to radiation & man-made radiation.

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I. INTRODUCTION

The Healthcare Industry in India is expected to touch 280 billion USD in 2020¹. The diagnostic medical imaging equipment such as X-rays, Digital radiography, and CT Scans contribute 75 percent of the total market share². The existing doctor and patient ratio in India are 1: 30,000, which is far less than WHO recommendation³ of 1:1000. The refurbishment market for diagnostic medical imaging has been a powerful contributor in India and expected to grow further. More than 200 Billion USD investment in medical infrastructure creation is projected to fulfill the demands forecasted for Tier II and Tier III cities of Indian market⁴ before 2020. Among 106 markets registered for the trading of refurbished medical devices, 85 markets permit the unrestricted importation of used medical devices, including India⁵. Most of the hospitals and diagnostic centers prefer refurbished diagnostic imaging equipment (CT, BMD, X-ray, and Mammography) due to lower cost without compromising the image quality. There have been no restrictions for the importation of the used medical imaging devices until 2015, by the regulator Atomic Energy Regulatory Body (AERB). However, effective September 2015, AERB has made an amendment in the regulatory process which restricts the importation of more than seven years old Pre-owned Medical X-ray equipment in the Country⁶. This change in regulatory norm has necessitated for a comprehensive review of the existing process practices to contain the excessive radiation.

II. LITERATURE SURVEY

The radiation studies have shown loss of six days of life expectancy due to diagnostic imaging X-rays⁷. The recommended radiation dose for initial diagnosis is between 0.1 and 100 mSv, while for therapeutic radiation it is between 20 - 60 Gy⁸. CT studies have revealed that more than 50 percent of the effective dose was contributed by diagnostic radiology⁹. Exposure beyond threshold levels was reported due to improper adjustments of operational controls¹⁰. There were more than 62 million CT examinations per year¹¹.

and the increasing number of recommendation for CT scan is a serious cause of concern¹². Studies have predicted more than 29,000 future cancers could be related to CT Scans¹³. The Exposure Index recommended by equipment manufacturers as a measure of radiation dose effectiveness was found to have inconsistencies¹⁴. The modern technologically driven radiation equipment offer high precision imaging with low dose levels¹⁵. These research studies mandate the need for immediate change over to innovative new technology medical imaging equipment by gradually eliminating the use of traditional technology equipments including refurbished X-ray equipments. This, establishes the need for stringent compliance with regulatory guidelines and standards towards protecting the existing installed base of X-ray equipment from excessive ionizing radiation and induce the adoption of newer generation equipment.

Studies related to regulatory compliance to contain ionizing radiation in Diagnostic Laboratories have shown adequate gaps in implementation¹⁶. Analysis of Regulatory compliance on Radiation Safety Parameters with Chain of Diagnostic Centers has cited lack of Top Management involvement¹⁷. Research work on 'Factors Influencing regulatory compliance to contain man-made ionizing radiation with corporate hospitals' has indicated more than required controls in place¹⁸. Research studies on 'Best Practices towards Radiation Safety Measures in Government Hospitals' have shown an extraordinary level of compliance¹⁹. The literature review has identified a research gap for conducting a study on 'Comparative analysis of Factors Influencing Radiation Control Measures.'

III. RESEARCH QUESTION

Do institutions housing Diagnostic Imaging X-ray equipment (Corporate Hospitals, Government

Hospitals, Chain of Diagnostic Centers and Private Diagnostic Centers) show similarity in Radiation Compliance Score?

IV. RESEARCH OBJECTIVES

To compare radiation compliance score based on the best practices recommended by the regulator (AERB) among Corporate Hospitals, Government Hospitals, Chain of Diagnostic Centers and Private Diagnostic Centers who are the consumers of X-ray equipments and analyze any significant variation exists.

V. RESEARCH DESIGN

This Descriptive Research aims at studying the current best practices followed by the institutions housing diagnostic imaging equipment, to contain excessive ionizing radiation based on the recommendations of regulatory standards. This study has covered 25 different cities across Tamil Nadu, India and covered 451 institutions (229 Private Diagnostic Centers, 107 Chain of Diagnostic Centers, 77 Corporate hospitals, and 38 Government hospitals). This study has followed "Stratified Purposive" sampling to ensure adequate representations from the entire stratum. A structured Questionnaire with a seven-point scale (Table I) was administered to collect data from the institutions housing diagnostic imaging equipment. The researcher conducted this study for the period between April 2016 and September 2017. The instrument reliability was tested using Cronbach's Alpha, and it was calculated to be 0.992 (Acceptable threshold limit is 0.8). The sampling adequacy was estimated using Kaiser-Meyer-Olkin test and was estimated to be 0.93839 (Acceptable limit is minimum 0.6).

Table I: Research Instrument Measurement Scale

0	1	2	3	4	5	6
No Practice Exist	Marginal Presence	Moderate Presence	Significant Presence	High Presence	Very High Presence	Complete Presence

VI. KRUSKAL-WALLIS TEST

The Kruskal-Wallis test (Kruskal, & Wallis, 1952) was chosen to test the hypothesis, 'Significant difference exists in the mean ranks of compliance score between

these institutions.' A descriptive analysis (Table II) was performed to assess the normality of data based on the compliance score. The histogram on the distribution of data was constructed (Figure I).

Table II: Descriptive analysis for Normality Test

Sl. No.	Description of Variable	N	Median	Mode	Mean	Std. Dev	Skewness	Kurtosis
1	Overall	28	5	6	4.54	1.654	-0.526	-1.348
2	Private Diagnostic Centers	7	2	2	2.8	1.069	0.374	-2.800
3	Chain of Diagnostic Centers	7	4	4	3.29	0.951	-1.678	-0.764
4	Corporate Hospitals	7	6	6	6	0	0.764	1.587
5	Government Hospitals	7	6	6	6	0	0.794	1.587

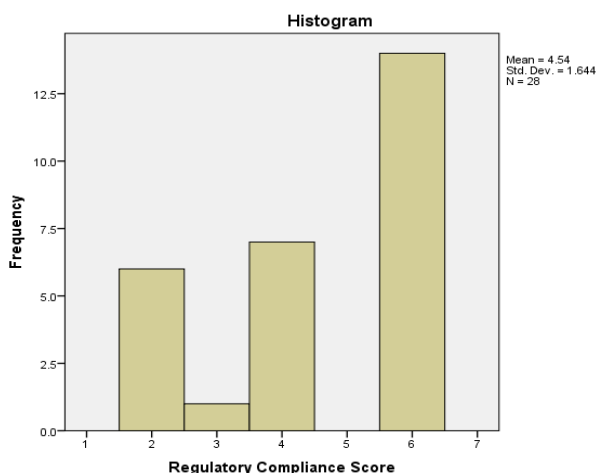


Figure 1: Histogram for distribution of compliance score

It was evident from the histogram that the data distribution is not normal (bi-nodal distribution). The

Skewness value estimated has shown both positive and negatively skewed data (- 1.678 and + 1.654). Kurtosis values estimated between - 2.800 and + 1.587 have described that the distribution is non-normal. Hence, the normality test results mandate the application of Kruskal-Wallis test as a statistical method for comparative analysis.

VII. TESTING OF HYPOTHESIS USING KRUSKAL-WALLIS TEST

The assumption on the existence of marginating variable was first tested to use the power of Kruskal-Wallis test. The marginating variable was tested with the help of the following hypothesis.

Null Hypothesis: "No marginating variance exists amongst the distribution from four (Diagnostic Centers, Chain of Diagnostic Centers, Government Hospitals, and Corporate Hospitals) groups".

Table III: Lewin's Test for Non-Parametric Statistics (ANOVA)

	Sum of Squares	df	Mean Square	F	Sig. ('P' Value)
Between Groups	862.607	3	287.536	39.807	.000
Within Groups	173.357	24	7.223		
Total	1035.964	27			

ANOVA was performed using absolute mean rank distribution values and results shown in Table III. The researcher rejected the null hypothesis based on the estimated 'P' value ('0'- zero) which is less than Alpha (0.05) value, and so it has been concluded that the variances are not roughly marginal.

VIII. KRUSKAL-WALLIS TEST

The test was conducted using SPSS (version 20), and test results of Kruskal-Wallis test have been compiled and presented in Table IV, V & VI.

Table IV: Estimation of marginating variable using Kruskal-Wallis Test

Compliance Score	Group	Group Description	Rank	Mean Rank Distribution	Absolute Mean Rank Distribution
2	1	Diagnostic Centers	3.500	2.86	.64
2	1		3.500	2.86	.64
4	1		11.000	2.86	8.14
4	1		11.000	2.86	8.14
2	1		3.500	2.86	.64
4	1		11.000	2.86	8.14
2	1		3.500	2.86	.64
3	2	Chain of Diagnostic Centers	7.000	3.29	3.71
2	2		3.500	3.29	.21
4	2		11.000	3.29	7.71
4	2		11.000	3.29	7.71
2	2		3.500	3.29	.21
4	2		11.000	3.29	7.71
4	2		11.000	3.29	7.71
6	3	Government Hospitals	21.500	6.00	15.50
6	3		21.500	6.00	15.50
6	3		21.500	6.00	15.50
6	3		21.500	6.00	15.50
6	3		21.500	6.00	15.50
6	3		21.500	6.00	15.50
6	3		21.500	6.00	15.50

6	4	Corporate Hospitals	21.500	6.00	15.50
6	4		21.500	6.00	15.50
6	4		21.500	6.00	15.50
6	4		21.500	6.00	15.50
6	4		21.500	6.00	15.50
6	4		21.500	6.00	15.50
6	4		21.500	6.00	15.50

Table V: Kruskal-Wallis Test Summary

Regulatory Compliance Score	Type of Institutions	N	Mean Rank
	Diagnostic centers	7	6.71
	Chain of Diagnostic Centers	7	8.29
	Government Hospitals	7	21.50
	Corporate Hospitals	7	21.50
	Total	28	6.71

Table VI: Test Statistics

Regulatory Compliance Score	
Chi-Square	23.988
df	3
Asymp. Sig.	.000

From the Kruskal-Wallis test results, the estimated 'P' value is '0' (Zero) which is less than the alpha value (0.05), and hence the hypothesis of 'There will be a significant difference in compliance score between these groups' has been accepted. There is a significant difference between mean ranks of Private Diagnostic Centers and Chain of Diagnostic Centers. However, the mean rank estimated for Government hospitals and corporate hospitals are found to be the same. The results though have shown a significant difference between the groups; it did not point out which group contributes notable variance. Hence the effect size was estimated using Chi-Square value (Chi-Square Value / n - 1 * 100) and found to be 85.37 percent. This

predicts 85.37 percent variability in mean rank is affected by the type of institutions.

The following groups formed to repeat the Kruskal-Wallis test to find out the group (s) that statistically significant from each other, and results are summarized:

1. Between Diagnostic Centers and Chain of Diagnostic Centers (Table VII & VIII).
2. Between Chain of Diagnostic Centers and Government Hospitals (Table IX & X).
3. Between Government hospitals and Corporate Hospitals (Table XI & XII).

Table VII: Kruskal-Wallis Test - Diagnostic Centers Vs. Chain of Diagnostic Centers

Regulatory Compliance Score	Type of Institutions	N	Mean Rank
	Diagnostic centers	7	6.71
	Chain of Diagnostic Centers	7	8.29
	Total	14	

Table VIII: Test Statistics

Regulatory Compliance Score	
Chi-Square	0.617
df	1
Asymp. Sig.	.432

The mean rank between Chain of Diagnostic Centers and Diagnostic Centers has been found to be statistically insignificant from the results of Kruskal-Wallis test with an estimated 'P' value of 0.432, which is

higher than the alpha value 0.05. Furthermore, Diagnostic centers and Chain of diagnostic centers attribute 4.41 percent of the variability in the mean rank.

Table IX: Kruskal-Wallis Test - Chain of Diagnostic Centers Vs. Government Hospitals

Regulatory Compliance Score	Type of Institutions	N	Mean Rank
	Chain of Diagnostic centers	7	4.00
	Government Hospitals	7	11.00
	Total	14	

Table X: Test Statistics

	Regulatory Compliance Score
Chi-Square	11.492
df	1
Asymp. Sig.	0.001

The mean rank between Diagnostic Centers and Government hospitals has been found to be statistically significant from the results of Kruskal-Wallis test with an estimated 'P' of 0.001, which is less than the

alpha value 0.05. However, Diagnostic centers and Government hospitals accredit 82.09 percent of the variability in mean ranks.

Table XI: Kruskal-Wallis Test - Corporate Hospitals Vs. Government Hospitals

Regulatory Compliance Score	Type of Institutions	N	Mean Rank
	Corporate Hospitals	7	7.50
	Government Hospitals	7	7.50
	Total	14	

Table XII: Test Statistics

	Regulatory Compliance Score
Chi-Square	0.000
df	1
Asymp. Sig.	1.000

The mean rank between corporate hospitals and Government hospitals has been found to be statistically insignificant from the results of Kruskal-Wallis test with an estimated 'P' of 1.00, which is higher than the alpha value 0.05. The 'Zero' chi-square value indicates that there is no significant difference in mean rank between Government hospitals and Corporate hospitals.

IX. CONCLUSION

It was evident from the analysis that there is a significant difference in regulatory compliance score between the groups of institutions compared. The mean compliance score of Private Diagnostic centers (2.8, Table I) enunciates that dissemination of radiation containment standards into best practices was found to be marginally less than significant levels. The Chain of Diagnostic centers have established practices whose compliance was closely above sufficient levels (mean score 3.29, Table. I). The Private Diagnostic centers and Chain of Diagnostic centers have established requisite practices to contain excessive ionizing radiation, leaving ample of improvement opportunities.

The Government and Corporate hospitals have established superior compliance to regulatory policies and fully translated standard requirements into more than adequate best practices. They are on par with each other and well supported by the test results that both the institutions have 'complete presence' of practices that ensure regulatory compliance. This study recommends further research work on 'Effective dose absorption between refurbished CT and new CT machine.'

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Adenocarcinoma of Left Maxilla: Case Report (Clinico Radiologic, Pathologic Features and Management)

By Dr. Manmeet Kour & Dr. Anshuman Dwivedi

Department of Oral Medicine and Radiology

Abstract- Very rarely malignant tumors of the nasal cavities and paranasal sinuses are seen. The incidence is less than one per cent of all tumors and less than three per cent of head and neck tumors in which most common is the carcinoma of the maxillary sinus. In this a case of adenocarcinoma with histopathology and treatment planning is discussed.

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Dr. Manmeet Kour ^α & Dr. Anshuman Dwivedi ^σ

Abstract- Very rarely malignant tumors of the nasal cavities and paranasal sinuses are seen. The incidence is less than one per cent of all tumors and less than three per cent of head and neck tumors in which most common is the carcinoma of the maxillary sinus. In this a case of adenocarcinoma with histopathology and treatment planning is discussed.

I. INTRODUCTION

Third most common malignant tumor in the salivary glands is Adenocarcinoma which accounts for less than 1% of all malignancies and for from 5% to 20% of all carcinomas in the sinonasal area.¹ Few reports in the literature describes the diagnostic imaging findings of adenocarcinoma arising in the maxillary sinus. They are painful, fast-growing masses, but occasionally present as painless and slow-growing.

II. CASE REPORT

A 48-year-old woman was referred to our hospital with the chief complain of swelling in the left upper facial region since 2-3 months. Patient did not give any positive history of any deleterious habit. On extra oral examination a soft, elastic mass of 29mm in diameter extending anteroposteriorly from the lower left eyelid till the inferior border of mandible and superoinferiorly extending from the left corner of mouth till the tragus of ear was seen. The overlying skin was normal as surrounding skin with a slight raise in temperature (Fig 1). On palpation the swelling was soft in consistency was compressible and tender. Patient also complained of the nasal congestion and left sub ocular tension. While palpating neck region a single lymph node of approx. 12mm in diameter was palpated at left level II region. On intra oral examination an ulcerative lesion was seen in the left maxillary arch region in relation to 27 28 with bluish discoloration around the ulcerative lesion. On checking the mobility status of 26 it was grade 3 mobile (Fig 2).



Fig. 1: Extra Oral View



Fig. 2: Intra Oral View

After clinical examination, the patient was advised for radiographic investigations (Panoramic imaging, Para Nasal Sinus View).

A panoramic radiograph showed massive bone destruction in the left maxillary arch region involving the floor of the sinus extending till the inferior orbital region. Slight radio-opacification is also seen in the left maxillary sinus region. In relation to 26 tooth region floating tooth appearance was seen. (Fig 3).



Fig. 3: Showing the Panoramic Radiograph

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The PNS view of the skull showed radiopacity in the left maxillary sinus, nasal cavity. The radiopacity was also appreciated in the left orbit with absence of a left maxillary tuberosity line and the lower border of left orbit. At this point, a malignant tumor was strongly suspected (Fig. 4).



Fig. 4: Showing the PNS View

After the basic radiographic examinations the patient was advised for the Contrast Enhanced Computed Tomography (CECT). The coronal sections of CECT shows a well-defined hypodense lesion in the left maxillary region extending into the left maxillary sinus, left nasal cavity and left orbit. The hypodense mass is also infiltrating into the buccinators and the masseter muscle involving the massetric space. Massive destruction of the alveolar bone, walls of maxillary sinus and inferior orbital wall can also be appreciated. (Fig 5).

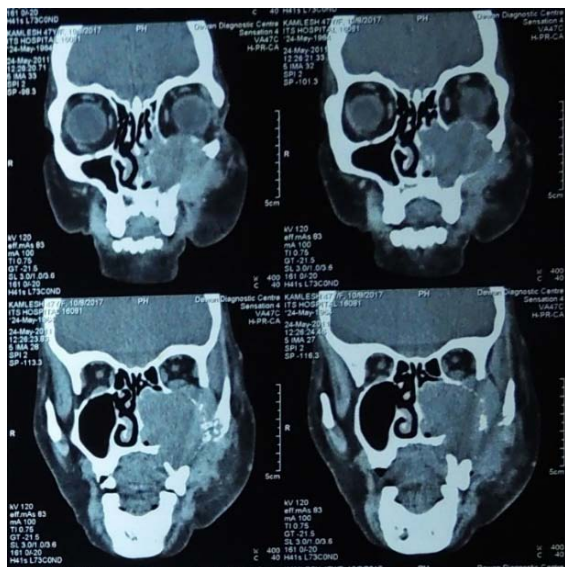


Fig. 5: Showing the Coronal View of CECT

The mass compressed the orbit base, but the orbit's contents were not affected. The maxillary tuberosity and the hard palate were destroyed. The CECT images also suggested that it was not a Squamous cell carcinoma but a malignant tumor.

After the radiological investigations the biopsy was performed which revealed parakeratinized stratified squamous epithelium overlying fibrocellular connective tissue stroma. The epithelium showed dysplastic features such as increased N: C ratio, prominent intercellular junctions, prominent and increased number of nucleoli, mitotic figures. Focal areas of invasion in the form of discrete tumor islands are seen. The C.T. stroma shows solid tumor mass areas with variable organisations formed by large polygonal cells having pale to eosinophilic cytoplasm and nucleus ranging from hyperchromatic to vesicular. Tumor cells were also arranged in forms of sheets, clusters, pseudoductal patterns with secretory material. Few cells also showed individual cellkeratinization, with numerous atypical mitotic figures. Tumor necrosis and perineural invasion was also observed and a diagnosis of Adenocarcinoma NOS (High grade) was given.

After the conformational biopsy report, surgical resection was done.

In the treatment tumors which have broad invasion into the maxillary sinus the Dieffenbach-Weber-Fergusson incision modified by Zange is used to perform a hemimaxillectomy (Fig 6). Before beginning the process of incision the area was marked and infiltrated with 1% xylocaine with 1 in 100,000 units adrenaline. After the incision cheek flap was elevated from the antero lateral surface of maxilla in the subperiosteal plane. Then dissection was slightly altered so that the involved skin overlying the anterolateral wall of maxilla was also removed ebloc along with the tumor. The lymph nodes upto level V were removed. Infra orbital floor defect was reconstructed by rotating temporalis muscle flap and facia lata graft was harvested (Fig 7).



Fig. 6: Showing Weber-Fergusson Incision



Fig. 7: Showing the Placement of Fascia Lata

After reconstruction the closure was done and the sample was send to pathology department for further special stains. The submitted resected tissue specimen impression was compatible with the incisional diagnosis of Adenocarcinoma NOS (High Grade). Level I lymph nodes shows tumor cells infiltration. No tumor invasion was seen in the Anterior, Posterior, Medial, Lateral and Superior margins and Periorbital fatty tissue. And the final impression of Adenocarcinoma NOS (High Grade) was given.

III. DISCUSSION

Third most common malignant tumor in the salivary glands is Adenocarcinoma which accounts for less than 1% of all malignancies and for from 5% to 20% of all carcinomas in the sinonasal area..They are painful, fast-growing masses, but occasionally present as painless and slow-growing. Classification of adenocarcinoma can be cytologic and architectural grades; grade I tumors are circumscribed and minimally invasive with mild pleomorphic features; grade III tumors are more solid, more pleomorphic, and have a greater mitotic rate; and grade II tumors lie between these two extremes. The present case falls in grade III. The stage and site of the tumor are important as they predict the patient survival rate. Treatment of choice always being Radical neck dissection, and the imaging characteristics were more in favor of a high-grade, cellular, infiltrating tumor.¹

In our case, the bone destruction was massive, considering that the tumor occupied the maxillary sinus, floor of orbit, left nasal cavity. These features are consistent with those of adenocarcinoma. This tumor was determined to be adenocarcinoma NOS, which means it does not belong to any pathological category, regardless of whether it is a malignant polymorphic adenoma or an adenoid cystic carcinoma.

Cancer of the maxilla can be a lethal disease, and its treatment often leaves the patient with marked functional and cosmetic deficits. Many different methods have been proposed for reconstructing these defects, which include a prosthetic obturator, temporalis

myofascial flap, infrahyoid myocutaneous flap and pectoralis myocutaneous flap.

Tensor fascia lata flap is a myofasciocutaneous flap that has been first described by Wangenstein in 1934 for abdominal wall reconstruction. This flap started to gain popularity after further description by Nahai, et al., 1978 and 1979. It has a significant role in the management of pressure sores, facial reanimation. Also, it has been used as a free flap in head and Neck reconstruction. In our case fascia lata flap was used for the reconstruction of the infra orbital floor.²

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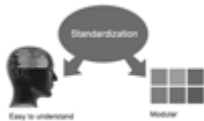


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- The paragraph before spacing of 1 pt and after of 0 pt.
- Line spacing of 1 pt.
- Large images must be in one column.
- The names of first main headings (Heading 1) must be in Roman font, capital letters, and font size of 10.
- The names of second main headings (Heading 2) must not include numbers and must be in italics with a font size of 10.

Structure and Format of Manuscript

The recommended size of an original research paper is under 15,000 words and review papers under 7,000 words. Research articles should be less than 10,000 words. Research papers are usually longer than review papers. Review papers are reports of significant research (typically less than 7,000 words, including tables, figures, and references)

A research paper must include:

- a) A title which should be relevant to the theme of the paper.
- b) A summary, known as an abstract (less than 150 words), containing the major results and conclusions.
- c) Up to 10 keywords that precisely identify the paper's subject, purpose, and focus.
- d) An introduction, giving fundamental background objectives.
- e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition, sources of information must be given, and numerical methods must be specified by reference.
- f) Results which should be presented concisely by well-designed tables and figures.
- g) Suitable statistical data should also be given.
- h) All data must have been gathered with attention to numerical detail in the planning stage.

Design has been recognized to be essential to experiments for a considerable time, and the editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned unrefereed.

- i) Discussion should cover implications and consequences and not just recapitulate the results; conclusions should also be summarized.
- j) There should be brief acknowledgments.
- k) There ought to be references in the conventional format. Global Journals recommends APA format.

Authors should carefully consider the preparation of papers to ensure that they communicate effectively. Papers are much more likely to be accepted if they are carefully designed and laid out, contain few or no errors, are summarizing, and follow instructions. They will also be published with much fewer delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and suggestions to improve brevity.

FORMAT STRUCTURE

It is necessary that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

All manuscripts submitted to Global Journals should include:

Title

The title page must carry an informative title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) where the work was carried out.

Author details

The full postal address of any related author(s) must be specified.

Abstract

The abstract is the foundation of the research paper. It should be clear and concise and must contain the objective of the paper and inferences drawn. It is advised to not include big mathematical equations or complicated jargon.

Many researchers searching for information online will use search engines such as Google, Yahoo or others. By optimizing your paper for search engines, you will amplify the chance of someone finding it. In turn, this will make it more likely to be viewed and cited in further works. Global Journals has compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Keywords

A major lynchpin of research work for the writing of research papers is the keyword search, which one will employ to find both library and internet resources. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining, and indexing.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy: planning of a list of possible keywords and phrases to try.

Choice of the main keywords is the first tool of writing a research paper. Research paper writing is an art. Keyword search should be as strategic as possible.

One should start brainstorming lists of potential keywords before even beginning searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in a research paper?" Then consider synonyms for the important words.

It may take the discovery of only one important paper to steer in the right keyword direction because, in most databases, the keywords under which a research paper is abstracted are listed with the paper.

Numerical Methods

Numerical methods used should be transparent and, where appropriate, supported by references.

Abbreviations

Authors must list all the abbreviations used in the paper at the end of the paper or in a separate table before using them.

Formulas and equations

Authors are advised to submit any mathematical equation using either MathJax, KaTeX, or LaTeX, or in a very high-quality image.

Tables, Figures, and Figure Legends

Tables: Tables should be cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g., Table 4, a self-explanatory caption, and be on a separate sheet. Authors must submit tables in an editable format and not as images. References to these tables (if any) must be mentioned accurately.



Figures

Figures are supposed to be submitted as separate files. Always include a citation in the text for each figure using Arabic numbers, e.g., Fig. 4. Artwork must be submitted online in vector electronic form or by emailing it.

PREPARATION OF ELETRONIC FIGURES FOR PUBLICATION

Although low-quality images are sufficient for review purposes, print publication requires high-quality images to prevent the final product being blurred or fuzzy. Submit (possibly by e-mail) EPS (line art) or TIFF (halftone/ photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Avoid using pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings). Please give the data for figures in black and white or submit a Color Work Agreement form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution at final image size ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs): >350 dpi; figures containing both halftone and line images: >650 dpi.

Color charges: Authors are advised to pay the full cost for the reproduction of their color artwork. Hence, please note that if there is color artwork in your manuscript when it is accepted for publication, we would require you to complete and return a Color Work Agreement form before your paper can be published. Also, you can email your editor to remove the color fee after acceptance of the paper.

TIPS FOR WRITING A GOOD QUALITY MEDICAL RESEARCH PAPER

1. Choosing the topic: In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

2. Think like evaluators: If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

3. Ask your guides: If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

4. Use of computer is recommended: As you are doing research in the field of medical research then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

5. Use the internet for help: An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow here.



6. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

7. Revise what you wrote: When you write anything, always read it, summarize it, and then finalize it.

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10. Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.



20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium through which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

INFORMAL GUIDELINES OF RESEARCH PAPER WRITING

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.



Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.



The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.



Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."



Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

THE ADMINISTRATION RULES

Administration Rules to Be Strictly Followed before Submitting Your Research Paper to Global Journals Inc.

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Segment draft and final research paper: You have to strictly follow the template of a research paper, failing which your paper may get rejected. You are expected to write each part of the paper wholly on your own. The peer reviewers need to identify your own perspective of the concepts in your own terms. Please do not extract straight from any other source, and do not rephrase someone else's analysis. Do not allow anyone else to proofread your manuscript.

Written material: You may discuss this with your guides and key sources. Do not copy anyone else's paper, even if this is only imitation, otherwise it will be rejected on the grounds of plagiarism, which is illegal. Various methods to avoid plagiarism are strictly applied by us to every paper, and, if found guilty, you may be blacklisted, which could affect your career adversely. To guard yourself and others from possible illegal use, please do not permit anyone to use or even read your paper and file.



CRITERION FOR GRADING A RESEARCH PAPER (COMPILATION)
BY GLOBAL JOURNALS

Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals.

Topics	Grades		
	A-B	C-D	E-F
<i>Abstract</i>	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
<i>Introduction</i>	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
<i>Methods and Procedures</i>	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
<i>Result</i>	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
<i>Discussion</i>	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
<i>References</i>	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring



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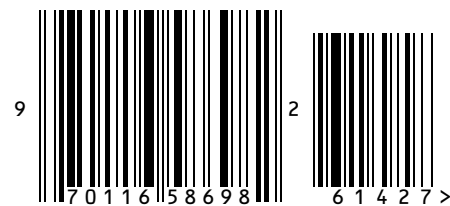
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