

# DEPARTMENTAL AUDIT ON THE APPROPRIATENESS OF C.T EXAMINATIONS

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## ABSTRACT

**OBJECTIVE:** To establish the appropriateness of C.T examination requests and to set guidelines in order to minimize inappropriate C.T examinations in future, to reduce both undue patient radiation exposure as well as to prolong x-ray tube life of C.T machine. **DESIGN:** Prospective Study. **PLACE AND DURATION OF STUDY:** This audit was conducted in Department of Radiology Sheikh Zayed Medical College Rahim Yar Khan for a period of two months after approval from institutional review board from 20-11-2022 to 20-01-2023. **METHODOLOGY:** Retrospective study was conducted for two months. All C.T examinations were evaluated by radiologists. Total 1101 examinations were evaluated and appropriateness rate (AR) was calculated for each anatomical region of examination. Data was statistically analyzed by 2x2 contingency table and chi square test. **RESULTS:** Out of 1101 C.T examinations 421 studies have findings with appropriateness ratio of 38.2%. Among all C.T examinations appropriateness rate was highest for musculoskeletal and head neck studies which was 100%. It was lowest for C.T brain examinations with appropriateness rate of only 34%. **CONCLUSION:** The appropriateness of C.T examination is not satisfactory. C.T brain have highest number of unnecessary examinations. PAEC clearly gives the National guidelines regarding radiation protection. One of the principle is justification of a radiological procedure which is in hand of a referring physician. A continued effort must be made to establish hospital guidelines to reduce the number of unnecessary examinations.

**Keywords:** Appropriateness Rate (AR), C.T scanner, guidelines

## Introduction

Unnecessary medical exposure increase the radiation burden to patient individually as well as staff and to population at large. It is therefore imperative to follow the rule of justification and optimization of radiological procedure in accordance to PAEC guidelines, at national and IAEA at international level. The BONN CALL FOR ACTION<sup>14</sup> organized by IAEA at Bonn Germany in 2012 and later in 2017 in Vienna Austria emphasizes on radiation protection practices especially in medical exposures to reduce undue radiation burden. Ten actions were proposed for next decade.<sup>15</sup>

One of the ten proposed actions was to do a strategic research for radiation protection in medical field. Similarly in a series of Radiation protection is a serious responsibility which must be achieved while delivering the radiological services. The ESR has developed GPS approach ( globalization, personalization, safety) to fully achieve the radiation protection goals. In addition undue and excessive exposures of C.T also reduces the tube life of scanner resulting in early tube failure and extra cost for repairing. This also halts the C.T services to people who need it during the

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repair time. The target of this audit was to evaluate the appropriateness of C.T examinations being held in Sheikh Zayed Medical College/Hospital so that future guidelines be formulated in order to minimize unnecessary examinations as laid down by American College of Radiologists (ACR) or the National Institute for Health and Care Excellence (NICE) of the United Kingdom until our own national guidelines are formulated.

## Methodology

The 128 slice Canon C.T scanner available in the institution makes it essential to conduct an audit to review the cases fulfilling the principle of justification. Although many C.T scanners are available in private sector but they are not well equipped with the latest applications. For the purpose of audit, auditor team was selected.<sup>4</sup>

The auditor team consists of consultant radiologists. They were arranged in two groups and evaluated the data for fifteen days each. They used the console of C.T workstation to evaluate each study.

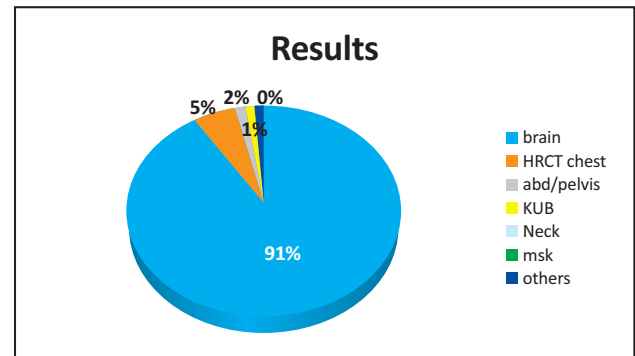
This audit was conducted in department of radiology for a period of two months after approval from institutional review board from 20-11-2022 to 20-01-2023. During this period all C.T examinations were included consecutively in the audit in prospective manner regardless of age and gender and history of trauma. These examinations were further evaluated by region of body requested to be imaged. Total 1101 cases were included. The region-wise data was collected and was divided into those examinations having findings versus normal studies. All the data was recorded manually in a register.

The data was evaluated by using Microsoft excel program. Bar chart and pie chart were constructed. Appropriateness rate (AR) for the C.T study of a specified anatomical region was calculated. It is defined as ratio between number of those studies with findings divided by total number of studies conducted for that particular anatomic region. Comparison of AR value for each group was performed by constructing 2 x 2 contingency table and chi – square test for statistical significance. A p-value less than 0.05 was considered statistically significant.

Statistical test were carried out by calculators available by [www.socscistatistics.com](http://www.socscistatistics.com)

## Results

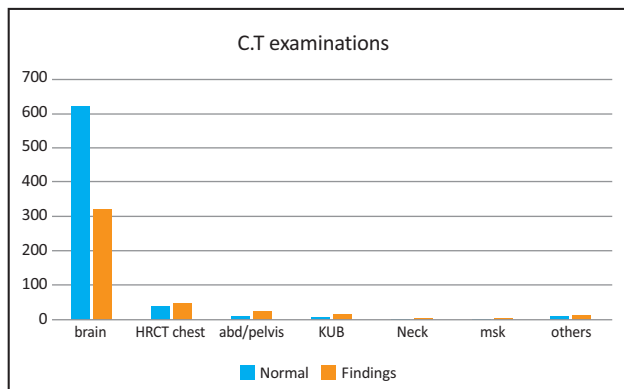
Total 1101 studies were included. Maximum number C.T studies were of brain as shown in pie chart and histogram:



Out of total 1101 studies only 421 studies reveal findings. Overall appropriateness ratio (AR) of 38.2% regardless of anatomical region. The appropriateness ratio (AR) for brain studies was found to be least that is only 34% and for HRCT it was 58%. Appropriateness ratio (AR) for abdomen and pelvic studies was 69% and for KUB it was 68%. It was 100% for head and neck and musculoskeletal C.T examinations. Finally AR was 62% for other miscellaneous studies. 2X2 contingency table was constructed between brain and rest of other studies and chi square test was applied which showed p-value of 0.00001 which is less than 0.05 hence findings are statistically significant.

	Brain	HRCT chest	Abd/pelvis	KUB	Neck	MSK	Others
Normal	619	36	10	7	0	0	8
Findings	319	49	22	15	2	1	13

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Normal	619	36	10	7	0	0	8
Findings	319	49	22	15	2	1	13
<b>Total</b>	<b>938</b>	<b>85</b>	<b>32</b>	<b>22</b>	<b>2</b>	<b>1</b>	<b>21</b>
<b>AR</b>	<b>34%</b>	<b>58%</b>	<b>69%</b>	<b>68%</b>	<b>100%</b>	<b>100%</b>	<b>62%</b>



## Discussion

The above described findings show unsatisfactory results especially regarding brain studies. Overall AR is only 38 percent. This raises the concern about undue radiation exposure as well as X-ray tube overload. If there is a choice between C.T and MRI then latter must be preferred according to rule of justification especially regarding brain studies which also increases the sensitivity of test. Despite the presence of MRI facility in the department the misuse of C.T is of high concern. The appropriateness of C.T examination referral is a prime most important step. Moreover there must some red flag signs proposed by Academic Council of the institution in cases of simple headache prior to C.T head examination. Most patients without any history of trauma and other complicated findings do not require imaging. The appropriateness rate (AR) for HRCT examinations showed much better results. The 100 percent AR for musculoskeletal and head neck studies are quite satisfactory. Burden on C.T could not be reduce by small amount of appropriate studies where bulk is contributed by C.T brain . In national radiological audit conducted in Luxembourg the appropriateness rate (AR) was higher for MRI as compared to C.T examinations especially in adult population.<sup>1</sup> Although it was an in depth audit for both MR and C.T examinations but there was higher inappropriate C.T requests by general physicians as compared to by a medical specialist. This result also concur with ours in this study .

In one of published audit by Muhammad Nawaz et al<sup>2</sup> showed out of 100 patients of paediatric age group

which were included in study only 4 had findings. So in Pakistan the inappropriateness of C.T examinations could be much higher.

## Conclusion

There is a need to conduct nationwide audit to analyze the appropriateness of radiological services. A nationwide guidelines must be set to minimize unnecessary radiological examinations. There is also a need to reduce self referral cases. Proper education of masses is a must for awareness about radiation hazards. Multiple examinations of the same patient must be discouraged and alternative non-ionizing way of imaging must be followed wherever feasible.

**DECLARATIONS:** Above described findings are genuine. The audit was done after approval from institutional review board. No financial or institutional conflict of interest.

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