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A study to compare the low-dose and standard-dose computed tomography for diagnosis of urolithiasis

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Abstract

Background: CT scan is very high sensitive in the diagnosis of calculi. However, it also has its own disadvantage and most important is its radiation. One of the most prominent radiations involved in the medical field is through the CT scan. Hence, it is better to use low dose CT as it emits less radiation than standard radiation.

Objectives: The current study was undertaken to observe the effectiveness of low dose CT by comparing with standard CT.

Methods: The present study involved 40 patients within the age group of 40 to 60 years of age who were suspected cases of urolithiasis and referred to radiology department for CT scan. Both males (n=18) and females (n=22) were included in the study.

Results: There was no significant difference between low dose and standard dose scoring. This clearly indicates that low dose CT is as efficient as standard dose and it can be used for multiple purposes.

Conclusion: The study observed no significant difference between the sensitivity levels among standard dose and low dose CT. The study recommends further detailed and multi centric studies to recommend use of low dose rather standard dose for benefit of general population.

Keywords: Radiology, urolithiasis, standard dose CT, low dose CT

Introduction

Presence of calculi in the urinary tract is called as Urolithiasis. These calculi can be located any area of the tract like it can be in kidney itself or it can be in urinary bladder also ^[1]. There is a strong need for the imaging techniques for these patients ^[2]. The requirement is to diagnose the calculi, during the treatment and also after the treatment for post assessment purpose ^[3]. The diagnostic value of radiography and sonography is limited for calculi detection ^[4-6]. Further, the excretory urography is a good choice but it is associated with pain and also takes lot of time. Another limitation to it is it is an invasive technique ^[7]. When compared with the computed tomography scan, the sensitivity of the urography is much less. In contrast, CT scan is very high sensitive in the diagnosis of calculi. However, it also has its own disadvantage and most important is its radiation. One of the most prominent radiations involved in the medical field is through the CT scan ^[8, 9]. Hence, it is better to use low dose CT as it emits less radiation than standard radiation. Earlier studies in this area reported that the low dose CT is effective in the diagnosis of calculi. Hence, the current study was undertaken to observe the effectiveness of low dose CT by comparing with standard CT.

Materials and Methods

Study design: Observational study

Sampling method: Convenient sampling

Study population

The present study involved 40 patients within the age group of 40 to 60 years of age who were suspected cases of urolithiasis and referred to radiology department for CT scan. Both males (n=18) and females (n=22) were included in the study. Voluntary informed consent was obtained from all the patients before the study. Willing participants, whose calculi can be seen with standard method, were included in the study. Patients with severe complications, pregnant women and obsess individuals were excluded from the study.

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Method of data collection: Data was collected using standard methods mentioned in the literature. Two expert and senior most radiologists evaluated the scans used in the study [10].

Ethical consideration: The study proposal was approved by an institutional human ethical committee. Informed consent was obtained from all the participants. Confidentiality of data was maintained.

Data analysis

Data was analyzed using SPSS 20.0 version. Student t-test was used to assess the significance of the difference

between the groups.

Results

Table 1 presents the calculi location and its distribution in patients. Table 2 presents the calculi location and its distribution in male patients. Table 3 presents the calculi location and its distribution in female patients. Table 4 presents the comparison of sensitivity levels of standard and low dose CT among male and female patients. There was no significant difference between low dose and standard dose scoring. This clearly indicates that low dose CT is as efficient as standard dose and it can be used for multiple purposes.

Table 1: Calculi location and its distribution in patients.

Location of calculi		Number of patients (n=40)	percentage
Right	Renal	6	15
	PUJ	10	25
	Ureteric	3	7.5
Left	VUJ	3	7.5
	Renal	6	15
	PUJ	4	10
Vesical	Ureteric	4	10
	VUJ	1	2.5
	Vesical	3	7.5

Data was presented as frequency and percentage

Table 2: Calculi location and its distribution in male patients

Location of calculi		Number of patients (n=18)	percentage
Right	Renal	2	11.11
	PUJ	1	5.55
	Ureteric	3	16.66
Left	VUJ	3	16.66
	Renal	3	16.66
	PUJ	1	5.55
Vesical	Ureteric	1	5.55
	VUJ	2	11.11
	Vesical	1	5.55

Data was presented as frequency and percentage

Table 3: Calculi location and its distribution in female patients

Location of calculi		Number of patients (n=22)	percentage
Right	Renal	3	13.63
	PUJ	4	18.18
	Ureteric	4	18.18
Left	VUJ	2	9.09
	Renal	1	4.54
	PUJ	2	9.09
Vesical	Ureteric	2	9.09
	VUJ	2	9.09
	Vesical	2	9.09

Data was presented as frequency and percentage

Table 4: Comparison of sensitivity levels of standard and low dose CT among male and female patients

Reader	Standard dose sensitivity	Low dose sensitivity	P value
1	412/412 (100%)	412/412 (100%)	NS
2	412/412 (100%)	412/412 (100%)	NS
1 and 2	824/824 (100%)	824/824 (100%)	NS

NS= not significant

Discussion

Formation of calculi in the kidney is called urolithiasis. The most common feature patients shows is presence of blood in the urine. Painful micturition is common symptom

experienced by these patients. As the calculi can be located anywhere in the urinary tract including kidneys, there is need to diagnose and locate the calculi effectively to plan the treatment strategies. Further, prognosis also essential as recurrent formation of stones is possible. So during the treatment and after the treatment these patients have to undergo the scanning procedures. CT scan was found to be more effective but associated with radiation. The current study was undertaken to observe the effectiveness of low dose CT by comparing with standard CT. There was no significant difference between low dose and standard dose scoring. This clearly indicates that low dose CT is as

efficient as standard dose and it can be used for multiple purposes. Patients with renal calculi have to undergo multiple times the scan procedures as the calculi. Because, the calculi may re appear. Maximum use of the scan process increased the radiation in the medical field ^[10]. As the patients have to be exposed to the radiation, the dose of radiation is a major concern. Exposing to higher dose multiple times is hazardous to health. There exist several studies to observe effect of dosage on radiation. It was explained that low dose of radiation is equally sensitive to standard dose ^[11]. There exist strong evidence for low dose usage in place of standard dose ^[12, 13]. It was reported that 35% decrease in the radiation for low dose CT is affective for abdominal scan ^[14]. The dose reduction is simple procedure and latest CT scan instruments have this feature inherent. The modification of tube current is simple process to adjust the radiation. However, the decrease in the radiation one should take account of the body part that has to undergo scan. Also one should keep importance about the sensitivity score should match even after reducing the amount of radiation. The present study is in agreement with earlier studies as it was observed that low dose is as effective as standard dose.

Conclusion: The study observed no significant difference between the sensitivity levels among standard dose and low dose CT. The study recommends further detailed and multi centric studies to recommend use of low dose rather standard dose for benefit of general population.

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