



Audit on Compliance to Guidelines in CT Scanning for Urolithiasis

ORIGINAL ARTICLE

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ABSTRACT

Introduction: According to the ALARA principle, CT-imaging procedures should be implemented to optimize radiation doses. The purpose of this study is to determine whether a quality control process has an impact on compliance with procedures.

Materials and methods: This retrospective study was conducted in three hospitals, focusing on the selection of the appropriate acquisition protocol and the reduction of acquisition height in abdominal computed tomography (CT) examinations performed to diagnose or rule out urolithiasis. A first audit was conducted to measure the compliance with the procedure. Next, a reminder of the CT-urolithiasis procedure was given to stakeholders. Three months later, a second audit was conducted to measure the impact of the repeat recall information on compliance, and to compare the outcome with an earlier audit conducted five years earlier.

Results: We included 517 'urolithiasis CT examinations'. The compliance ranged from 41.67% to 64.8% for the first audit. After the reminder of the urolithiasis procedure, compliance ranged from 50% to 76.10%. This improvement was statistically significant for hospital A and B ($p < 0.001$ for hospital A, $p = 0.013$ for hospital B) but not for hospital C ($p = 0.405$). Despite prior demonstration that improved compliance persisted at one year from an initial audit, our actual data show that this compliance had decreased at year five, confirming the need to repeat compliance audits more frequently, or to monitor it continuously.

Conclusion: Surveying compliance to procedures can improve compliance but only for a limited duration. Monitoring compliance more frequently or even continuously is recommended.

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		FIRST AUDIT	SECOND AUDIT	P VALUE
Hospital A	0 criterion	35.2% (44/125)	23.9% (38/159)	<0.001
	1 criterion	52.8% (66/125)	38.4% (61/159)	
	2 criteria	12% (15/125)	37.7% (60/159)	
	At least 1 criterion	64.8% (81/125)	76.10% (121/159)	
Hospital B	0 criterion	53.9% (55/102)	38.9% (44/113)	0.013
	1 criterion	29.4% (30/102)	27.5% (31/113)	
	2 criteria	16.7% (17/102)	33.6% (38/113)	
	At least 1 criterion	46.08% (47/102)	61.06% (69/113)	
Hospital C	0 criterion	58.33% (7/12)	50% (3/6)	0.501
	1 criterion	25% (3/12)	50% (3/6)	
	2 criteria	16.67% (2/12)	0% (0/6)	
	At least 1 criterion	41.67% (5/12)	50% (3/6)	
Hospital A. B and C	0 criterion	44.35% (106/239)	30.94% (86/278)	<0.001
	1 criterion	41.42% (99/239)	34.17% (95/278)	
	2 criteria	14.23% (34/239)	35.25% (98/278)	
	At least 1 criterion	55.65% (133/239)	69.42% (193/278)	

Table 1 Compliance with Urolithiasis Procedure according to Hospitals.

These examinations were transferred to a dedicated server and data analysis was performed on this server, with complete anonymization of patient's data except for their age and gender.

Information regarding CT examinations was collected retrospectively and included: patient's age, examination indication (lithiasis control, renal colic, pain in the right or left iliac fossa), procedure choice, acquisition length, radiation dose descriptors and the radiologist's name, which was also anonymized.

A first audit period took place from February to April 2021. During May 2021, the radiologist responsible for quality control and radioprotection in the department reminded the stakeholders of the urolithiasis procedure. A second audit analyzed data from June to August 2021.

IMAGE ANALYSIS

Compliance with the procedure was evaluated according to two criteria: the selection of the appropriate acquisition protocol and the reduction of acquisition height with exclusion of the top of the liver. For each exam, we collected the DLP and CTDI_{volume}.

STATISTICAL ANALYSIS

We calculated the proportion of examinations performed according to the urolithiasis procedure amongst all the urolithiasis CT scans performed during both audit periods and per radiologist. The proportion comparisons were calculated using the χ^2 Pearson test.

We performed a Shapiro-Wilk test to testify the normality of our quantitative variables.

We compared medians using the Mann-Whitney test. Statistical significance was set for p values < 0.05.

3. RESULTS

We included 517 urolithiasis CT examinations. The median patient age was 50 years for the first period and 50 years for the second period (p = 0.770).

UROLITHIASIS PROCEDURE

Table 1 summarizes the percentages and proportions of urolithiasis examinations conducted in compliance with the procedure for the three hospitals for both periods.

We reached statistical significance for hospital A and B (p < 0.001 and p = 0.013 respectively) but not for hospital C (p = 0.405).

Figure 1 illustrates 3 examples of CT-scans in the coronal plane from patients with similar diameters and different acquisition lengths and/or protocol selections.

RADIOLOGIST DEPENDENCY

Table 2 summarizes the percentages and proportions of urolithiasis examinations conducted in compliance with the procedure for each radiologist.

RADIATION DOSE

The median DLP was 162.6 mGy.cm (p25: 77 | p75: 256.2) for the first audit and 95.2 mGy.cm (p25: 58.65 | p75: 216) for the second audit (p < 0.001).



Figure 1 CT examination for urolithiasis in coronal section for three patients of similar diameters: **(a)** wrong acquisition length and protocol selection – DLP 206.1 mGy.cm **(b)** right protocol but wrong acquisition length – DLP 82.4 mGy.cm **(c)** right protocol selection using Tin Filter and right acquisition length – DLP 34.3 mGy.cm.

AUDIT INTERVAL

Compared with Oliveri's one-year control, which had reached a compliance of 85%, our first audit conducted five years later shows a drop to 55.65% of the compliance to the urolithiasis procedure and our second audit reached 69.42%.

4. DISCUSSION

Our study showed that 1) while procedures are established to optimize the radiation dose, compliance remains imperfect; 2) surveying compliance with procedures and informing the radiology staff on this compliance increases compliance over time; 3) the increase is not statistically significant for every hospital, even though they belong to the same health group and radiology department; 4) compliance with the second criteria (shortening the acquisition length) is lower than that of selecting the appropriate reduced-dose protocol;

and 5) compared with the 2016 study, compliance dropped.

THESE OBSERVATIONS DESERVE FURTHER DISCUSSION.

First, regarding the impact of surveying compliance, our findings are consistent with those reported by Oliveri et al. showing an increased compliance after informing the staff [10]. However, they also demonstrate that the compliance which proved to be stable at one year, decreased thereafter.

Indeed, the percentage of compliance with the urolithiasis procedure had reached 85% by the end of the study, but our first audit, which took place in the same radiology department five years later, reached only 55.65%. This suggests that the effect of one quality control process on compliance decreases over time. To ensure a sustainable improvement with compliance, these audits should be repeated regularly, as required by the Federal Agency for Nuclear Control (FANC) since 2020

