

ELIMINATION OF PLAIN SCAN IN PEDIATRIC NECK, CHEST AND ABDOMEN-PELVIS CT EXAMINATIONS, SINGLE CENTER AUDIT

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ABSTRACT

INTRODUCTION: According to our departmental practice, all pediatric Neck, Chest and Abdomen-Pelvis (NCHAP) Computed Tomography (CT) examination were performed in two phases: plain scan and contrast enhanced scan. This practice resulted in doubling of radiation exposure to the patient. Other excuses were higher CT tube burden and longer exam time as some children need to be slept or sedated for examination. **OBJECTIVE:** We aimed to eliminate the plain scan in pediatric NCHAP CT examinations (except case of urolithiasis) without affecting its diagnostic value of examination in order to reduce the radiation dose, tube burden, examination time and possible examination cost. **METHODS AND MATERIALS:** A prospective single center clinical audit was performed from 1st may 2016 to 31st August 2016. Clinical indications of referral physicians were reviewed. Only contrast enhanced scans were obtained by 128 slice Siemens scanner. Images were evaluated by senior CT radiographer, radiology resident and radiologist respectively and need of plain scan was judged accordingly. **RESULTS:** Total 202 pediatric NCHAP examinations were performed at our department during this period. Among these examinations; only in 3 cases (2 neck and 1 abdomen CT) plain CT scans were assumed to be helpful. **CONCLUSION:** Plain scans should be omitted in all pediatric NCHAP CT examinations (except in cases of urolithiasis) that will reduce the radiation exposure to half.

Key words: Computed tomography, pediatrics, radiation.

Introduction

According to our departmental practice, all pediatric Neck, Chest and Abdomen-Pelvis (NCHAP) Computed Tomography (CT) examination were performed in two phases: plain scan (without contrast) and contrast enhanced scan. This practice resulted in doubling of radiation exposure to the patient. Other excuses were higher CT tube burden and longer exam time as some children need to be slept or sedated for examination.

Objective

To eliminate the plain scan in pediatric NCHAP CT examinations (except case of urolithiasis) without

affecting its diagnostic value of examination in order to reduce the radiation dose, tube burden, examination time and possible examination cost.

Methods and Materials

A prospective single center clinical audit was performed. Consecutive sampling was done including all pediatric NCHAP CT examination in radiology department of French Medical Institute for Mothers and Children (FMIC) from 1st may 2016 to 31st August 2016. Cases for urolithiasis were excluded as they are diagnosed with plain scans.

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Clinical indications of referral physicians were reviewed. Only contrast enhanced scans (intravenous injection of non-ionic water soluble contrast material [Omnipaque 300]) were obtained by 128 slice Siemens scanner.

Images were evaluated by senior CT radiographer, radiology resident and radiologist respectively and need of plain scan was judged accordingly. If non enhanced scan were assumed to be needed, 24 hour delayed plain scan was taken. With and without contrast images were compared to look if any additional diagnostic value was added or not.

The data were collected using structured data collecting instrument and analyzed using Statistical Package for Social Science (SPSS) version 23.

Results

Total two hundred and three (n=202) NCHAP examinations were performed at our department during this period. 112 patients (55.4%) were male and 90 (44.6%) were female. The patients were aged from 1 day to 18 years (mean 6.5 + SD 5.2 years). A total of 98 (48.5%) exams were abdomen-pelvis, 78 (38.6%) chest and 26 (12.9%) being neck (Tab. 1). The disease categories are shown in (Tab. 2).

Characteristics	N	%
Age in years Mean ± SD	6.5 + SD 5.2	
Gender		
Male	112	55.4
Female	90	44.6
Type of examination		
Abdomen-pelvis	98	48.5
Chest	78	38.6
Neck	26	12.9

Table 1: Demographic characteristics of the patients

Need for plain scan:

After evaluation of contrast enhanced scans, the need for plain scan was evaluated for each examination (Chart 1). Among 26 neck CT exams, 2 cases appeared to need plain scan. The first case was clinically suspected for sialolithiasis and the second being a thyroid nodule with heterogeneous hyperdense area which could not be differentiated whether it is calcifi-

Category	N	%
Normal CT findings	11	5.4
Neoplastic processes	53	26.2
Congenital anomalies	43	21.3
Infectious process	69	34.2
Trauma	7	3.4
Other	19	9.4
Nonspecific enlarged lymph nodes	5	2.5
Biliary stone/sludge	2	1.0
Cholecystitis and pancreatitis	1	0.5
Chronic liver disease	1	0.5
Foreign body aspiration	1	0.5
Pulmonary embolism	1	0.5
Isolated pleural effusion	2	1
Pulmonary edema	2	1
Small airway disease	1	0.5
Trichobezoar	1	0.5
Enlarged thymus gland	1	0.5
Nonspecific ascites	1	0.5
Total	202	100

Table 2: Frequency of various pathologies

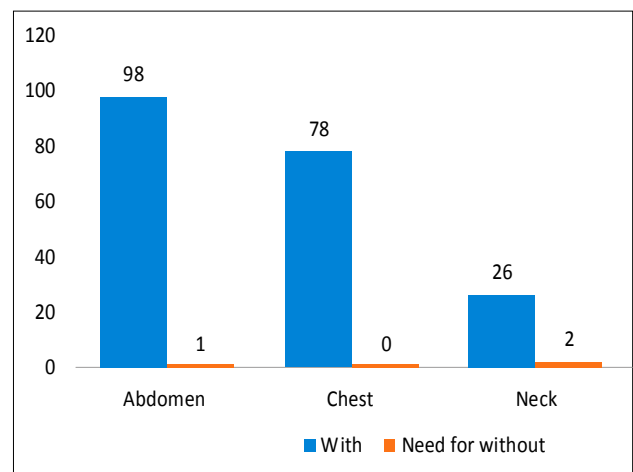


Chart 1: Bar chart demonstrates the need for plain scan in NCHAP CT examinations, only in three cases the plain scan was presumed to be helpful.

cation or intense enhancement (Fig. 1). None of the 78 chest CT examinations needed plain scan. Among 98 abdomen-pelvis CT examination in one case of choledocholithiasis plain scan was obtained (Fig. 2).

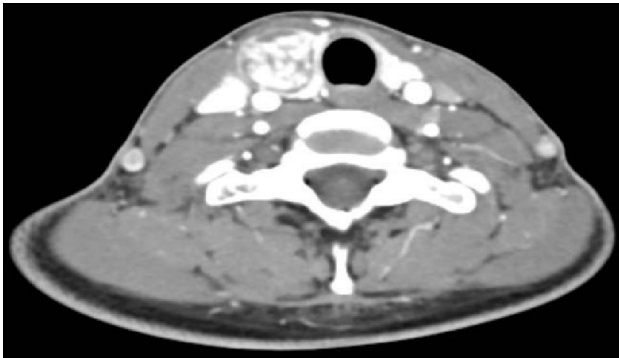


Figure 1: Thyroid nodule: enhancement versus calcification: 18 years old female with thyroid nodule; contrast enhanced axial CT section shows heterogeneous hyperdense lesion, however CT is not the preferred modality for evaluation of such solitary nodule of thyroid which can be better evaluated with ultrasonography.

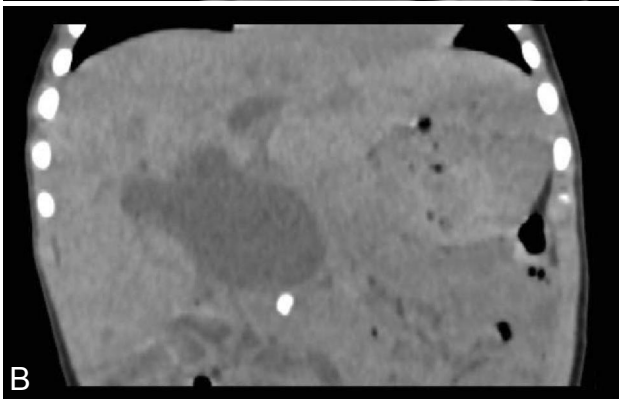


Figure 2: Choledochal cyst and choledocholithiasis in a 13 year old boy: **A:** Contrast enhanced sagittal CT section demonstrates a well-defined, thin walled cyst in the portahepatis (Choledochal cyst) with a hyperdense focus distal to it (choledocholithiasis). **B:** 24 hour delayed non-enhanced coronal CT section demonstrates the calculus.

Discussion

Computed tomography (CT) is an important radiological examination which uses X-radiation for image formation. Because of the potential risk of high radiation exposure, pediatric CT is a public health concern. The major concerns in children are more sensitivity to radiation, longer life expectancy and higher intake of unnecessary radiation due to smaller body size.¹ Contrast material is used for opacification of the structures to reach the diagnosis. In cases of urolithiasis without contrast images are necessary to detect the lithiasis.²

Suspected sialolithiasis is an indication for plain CT if not detected with ultrasonography and plain radiography.³ In the case of suspected thyroid nodule with heterogeneous hyperdense areas, ultrasonography could better differentiate calcification from intense blood flow so plain scan was not obtained.⁴ In the case of choledocholithiasis delayed non-enhanced scan was obtained, however subsequent comparison of both scans revealed that indeed the contrast enhanced scan could provide adequate information and plain scan was not so necessary.


Conclusion

Plain scans should be omitted in all pediatric NCHAP CT examinations (except in cases of urolithiasis) that will reduce the radiation exposure to half. Contrast enhanced images should be evaluated and if rarely there is need of plain scan, delayed scan can be performed according to the region of interest.

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