Clinical diagnostic reference levels in diagnostic radiology: preliminary results in Qatar

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INTRODUCTION

Diagnostic reference levels (DRLs) in the international literature are mostly set for certain anatomical regions [1]. The limitation of anatomical DRLs, however, is that for one anatomical region of the patient body more than one clinical indication (CI) is applicable.

Each of these CIs require very different CT protocols to answer the clinical question with very different patient radiation exposure. The last few years, the term clinical DRLs is introduced with limited number of studies defining DLRs in terms of CI [2-5].

Also, recently a European Project was funded by the European Commission with the aim to define clinical DRLs for the most important clinical indications from the radiation protection perspective across Europe .

AIM

The aim of the study was to define clinical DRLs for CT and Interventional Radiology (IR) procedures in Qatar.

To design a survey, collect data and define clinical DRLs for the most important clinical indications from the radiation protection point of view, specifically for Qatar demographic local situation.

METHOD

- The study was conducted in Hamad Medical Corporation (HMC), the main provider of secondary/tertiary healthcare in Qatar. HMC manages 13 hospitals, the National Ambulance Service and home/residential care services.
- The CIs (10 CT and 3 IR) were chosen based on exam frequency. These ranged from CT evaluation in stroke, pre-evaluation in transcatheter aortic valve implantation to abdominal-pelvic CT for liver/abdominal metastases in colorectal cancer, IR for brain embolization and treatment of aneurysms.

RESULTS

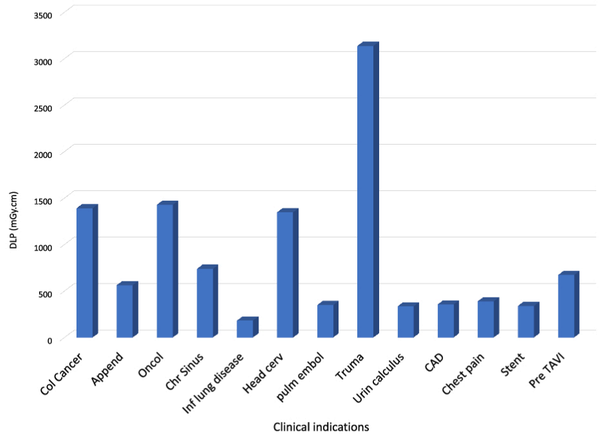
Patient sample included 1108 patients undertaking CT for 10 CIs and 3 neurological IR procedures.

HMC has a dose monitoring system (Radiation Dose Monitor (RDM) Software, PACS Health, LLC) which facilitated collection of patient clinical/technical data. CT Effective dose (E) values were calculated by the RDM software. Methodology to develop DRLs followed international recommendations.

Quantities for DRL determination were a) CT: Dose Length Product (DLP) and E, b) IR: Kerma Area Product (KAP), Fluoroscopy time in min (T), number of images (F)

CT median values for DLP and E ranged from 181 Gy.cm (diffuse infiltrative lung disease) to 3137 Gy.cm (truma) and 3.6 to 38.6 mSv, respectively. IR DRL median values range; KAP: 67-188 Gy.cm2, T: 12.4-33.7 min and F: 439-1298 images. The max/min dose ratio was 23 for CT and 2.8 for IR procedures.

These clinical DRLs values were endorsed by the Medical Physics Society of the state of Qatar and are in the implementation process to be approved by the regulatory authority.



The median values for DLP (mGy.cm) for different clinical indication

The clinical indications (CIs) are shown below for computed tomography (CT)

Number	Clinical Indication
1	Abdominopelvic CT for liver and abdominal metastases in colorectal cancer
2	Appendicitis
3	Chest-abdomen-pelvis for oncologic follow-up
4	Chronic sinusitis
5	Diffuse infiltrative lung disease
6	Acute head trauma/Cervical spine trauma
7	Pulmonary embolism
8	Total body CT in severe trauma
9	Urinary calculus
10	Coronary artery disease (CAD)
11	Chest pain
12	Stent
13	Severe aortic stenosis; CT Aortic Angiography for pre Transcatheter Aortic Valve Implantation (TAVI) evaluation

CONCLUSIONS

Preliminary clinical DRLs were established for 10 CT and 3 IR CIs in Qatar. The large differences in radiation dose, especially for CT, justify use of CI in DRL determination and points to immediate actions for dose optimization.

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