Cumulative radiation CT dose in young traumatic patients: a single centre 5 years retrospective review

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Aims and objectives

Multidectector CT (MDCT) examinations represent relatively high patient radiation exposures to an increasing number of patients. In emergency care has transformed patient management and its use is dramatically grown; in Italy at least 2 million of exams (29.9%) were recorded in 2009 in emergency department on 6 million of total exams performed per year with an estimated increase rate of 40% in five year [1-2].

This increase rate is mainly to the images speed, technology advance and wide spread access to MDCT allowed in emergency departments. On the other hand some concerns are emerging about appropriateness, costs control, resource utilization and costs in term of radiation exposure. MDCT is the main source of radiation in trauma patients because of the above mentioned reasons and because patients referred for trauma are submitted to multiple MDCT scans for diagnosis, surgical complications and follow-up in a short period of times.

Despite "cumulative risks" is under debate and criticize from many authorities in radiation protection, some reports emphasised that some patients received very high dose from multiple radiological examinations [3]. The aim of the present research was to evaluate in a single centre a major trauma centre (University hospital of Palermo Policlinico) that potentially may serve 1 millions habitants. The number of repeated MDCT examinations in young adult patients in the last 5 years.

Methods and materials

The number of MDCT and relative radiation dose was retrospectively searched in young adult trauma patients (range 16-40yrs), in the last 5 years (2007-2012). From the reporting database all patients referred for trauma that were submitted to more than one MDCT scan were selected. Dose report form PACS was also associated in a home made excel based system.

We identified 84 trauma patients, with a mean age of 29 years (21 females and 63 males) who underwent more than one MDCT for diagnosis, surgical restaging and complications evaluations. The referral reason and final diagnosis were searched in RIS system and hospital records database. The home made excel system included referral reason for each exam performed initial and final diagnosis (if differs). In Table 1 number of MDCT scans, type of examination, exam's date, body part examined, age and dose reports has been shown.

The exams included in the study were performed with two different MDCT apparatus: a 128-slice CT (SOMATON Siemens Definition AS) and a 16-slice CT (GE Bright Speed Elite) .

The dose values were calculated by using the dose lenght product (DLP). The "k" conversion coefficients which allow to obtain the effective dose (E) from the DLP values were used. In particular, the effective dose values were calculated according the following formula: E = k × DLP, where DLP = dose-length product [4-7].

The "k"conversion coefficients used are reported in the tables 1

Table 1

Anatomic Region	EC Appendix C [1] (2004) and NRPB-W67 [2] (2005) [mSv / (mGy × cm)]
Head	0.0021
Head and neck	0.0031
Neck	0.0059
Chest	0.014
Abdomen	0.015
Pelvis	0.015
Chest, abdomen, and pelvis	0.015

Note-EC = European Commission, NRPB = National Radiological Protection Board.

Results

In the retrospective study were identified 84 traumatic patients were submitted to a mean of 2.8 MDCT scan .

The distribution of MDCT scans for regions of the body was examined (Fig1):
• 190 head

• 21 thorax

• 39 abdomen

• 8maxillo-facial

• 5 extremities

• 2 cervical spine

• 2 neck

• 2 lumbar spine

• 3 in other regions.

The age distribution can be considered similar to a uniform distribution and this is correlated to the fact that this kinds of MDCT exams can be perfomed with the same probability independently of the patients'age. However, deviations from uniform distribution can be noted for young patients (below 20 years) and for patients with age around 40 years (Fig.2).

The distribution is characterised by high values in the low dose range (below 20 mSv). However, in 29 patients, the effective dose was found to be higher than 20mSv (Fig 3).

We also observe that:
• The peak age is between 29 years.
• There is a significant correlation between days of the week, mostly on weekends, and the repetition of MDCT scans.
• The interval of repeated scans is mainly in 24-72 hours from access to the emergency department.

Images for this section:

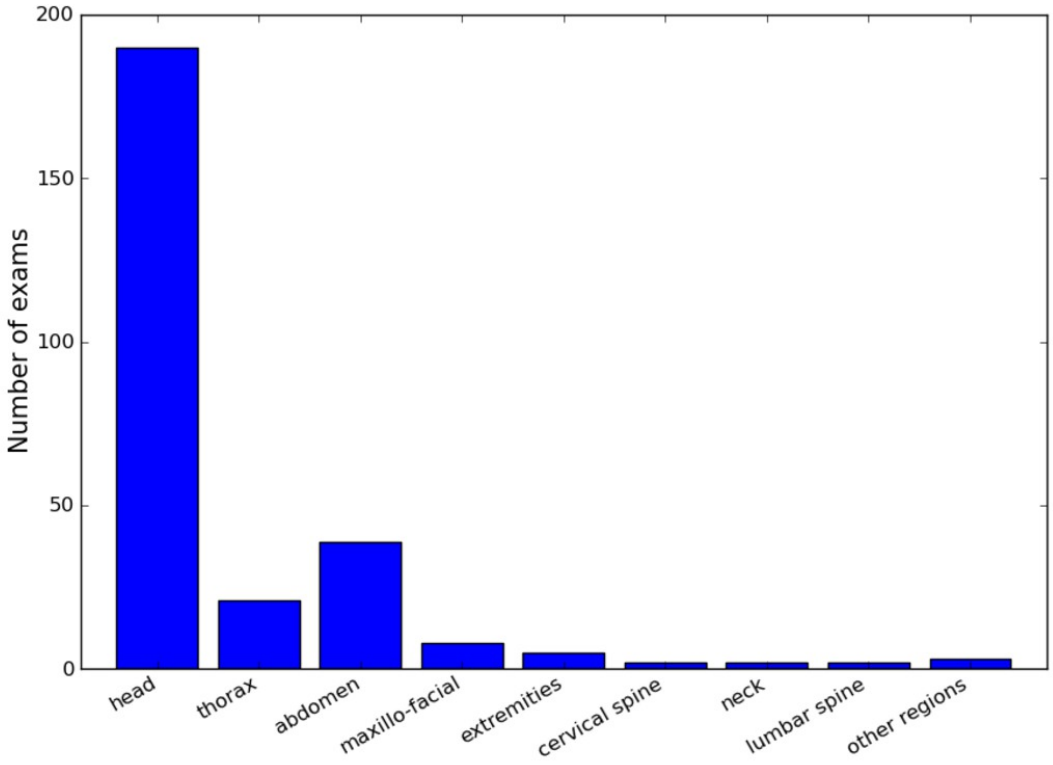

Fig. 1: Examinations distribution.

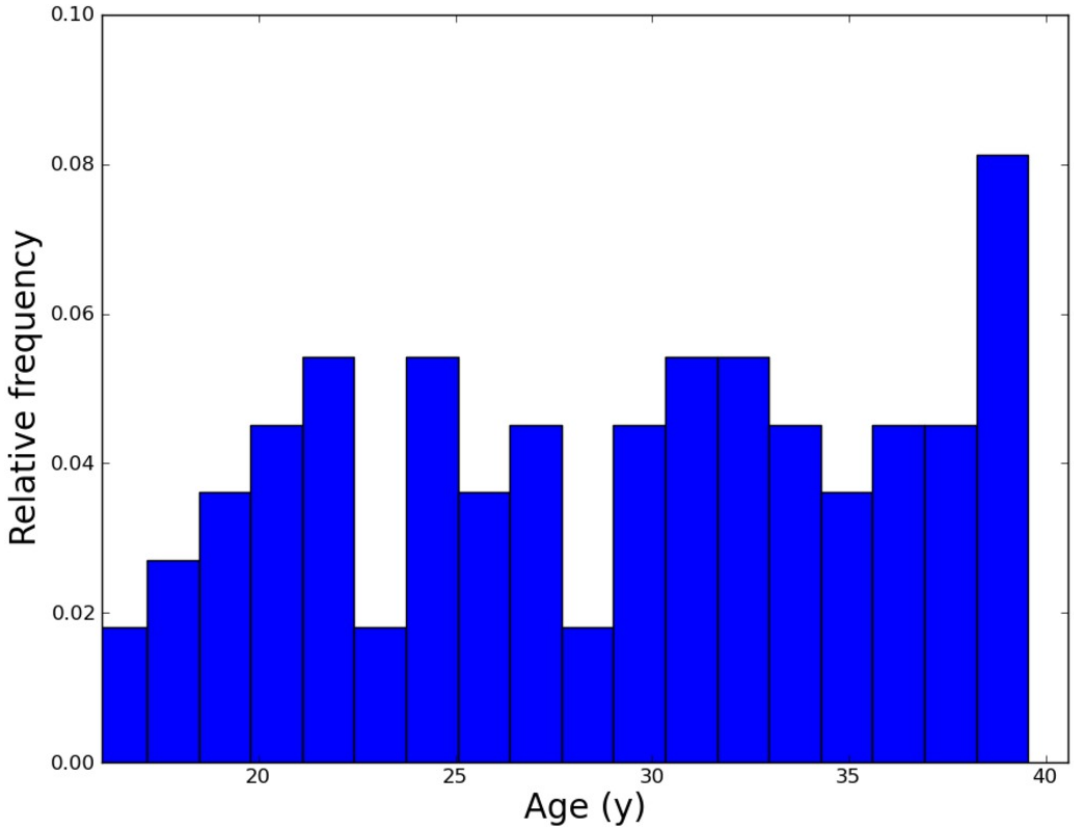

Fig. 2: Age distribution of the patients.

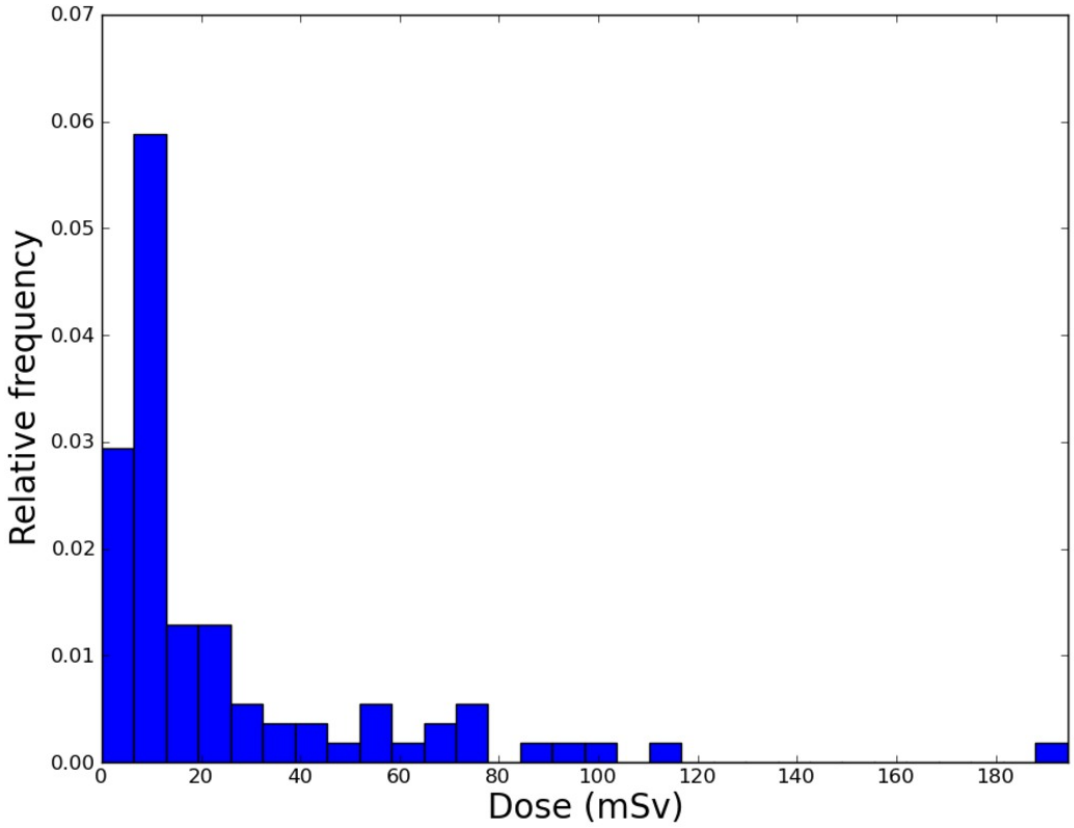

Fig. 3: Dose distribution.

Conclusion

The usefulness of MDCT in the diagnosis and management of complicated trauma patients is well known and it is confirmed by the wide use in the general population. However, the risks of multiple exams and consequent cumulative radiation dose should better considered and risk-benefit considerations should be done with the aim at decreasing radiation dose exposure.

Therefore, some measures that will decrease exposure and also the number of examinations are fundamental. Particular attention must be given to the development of standardized protocols for the optimization of the exposure settings, based on the size of the patient and the clinical indications.

Personal information

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