RECURRENT EXPOSURE OF PATIENTS WITH CHRONIC CONDITIONS IN A SMALL PRIVATE MEDICAL CENTER

Olga Irina Girjoaba

Academica Medical Center, Bucharest

INTRODUCTION

- *One of the topics recently proposed by the IAEA on the medical exposure to ionising radiation is the recurrent exposure of patients with chronic conditions, at short intervals, using highly irradiating procedures such as CT examinations and interventional cardiological and non-cardiological procedures.*

- *An IAEA study presents that the number of patients who have received cumulative effective doses (CED) in the 50-500 mSv range, over a period of 1-5 years, has increased a lot in recent years.*

- *Based on these considerations, we performed a study referring to the evaluation of CED due to recurrent CT exposures, performed with a CT unit GE Bright Speed 16, in a private medical center focused on the follow-up on the evolution of malignant diseases of the patients, during the treatment process.*

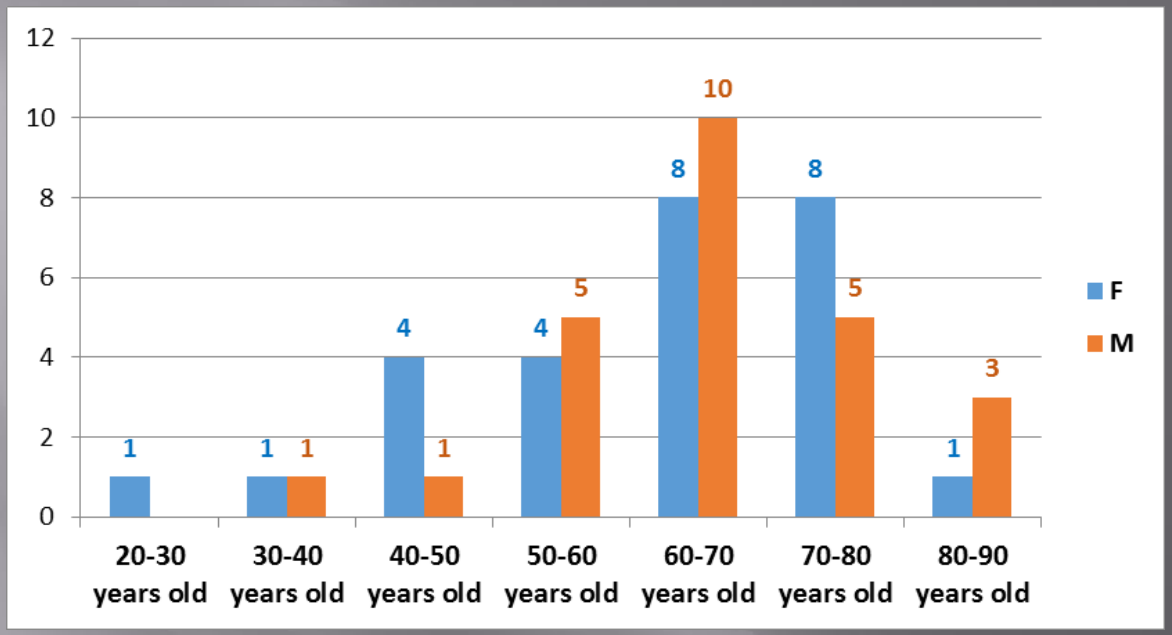
METHOD

- In our study, we used a local electronic system for individual registration of medical exposures, that provides information about patient data and also about scan parameters, including total dose-length product (DLP), for every exam performed.
- Based on this information, CED was evaluated for patients with recurrent exposure.
- We analyzed a group of 350 patients randomly chosen, that performed 500 CT examinations, 52 patients from the total number (14.8%) presenting recurrent exposures over a period of 1-5 years.

- Justification of these recurrent exposures is in accordance with clinical protocol for every type of treatment that impose, as regular control, a CT exam at 6 months after surgery, or a CT exam at every 3 months for verification of response of the chemotherapy, or in case of immunization treatment for breast cancer or melanoma, a CT exam at every 3 weeks

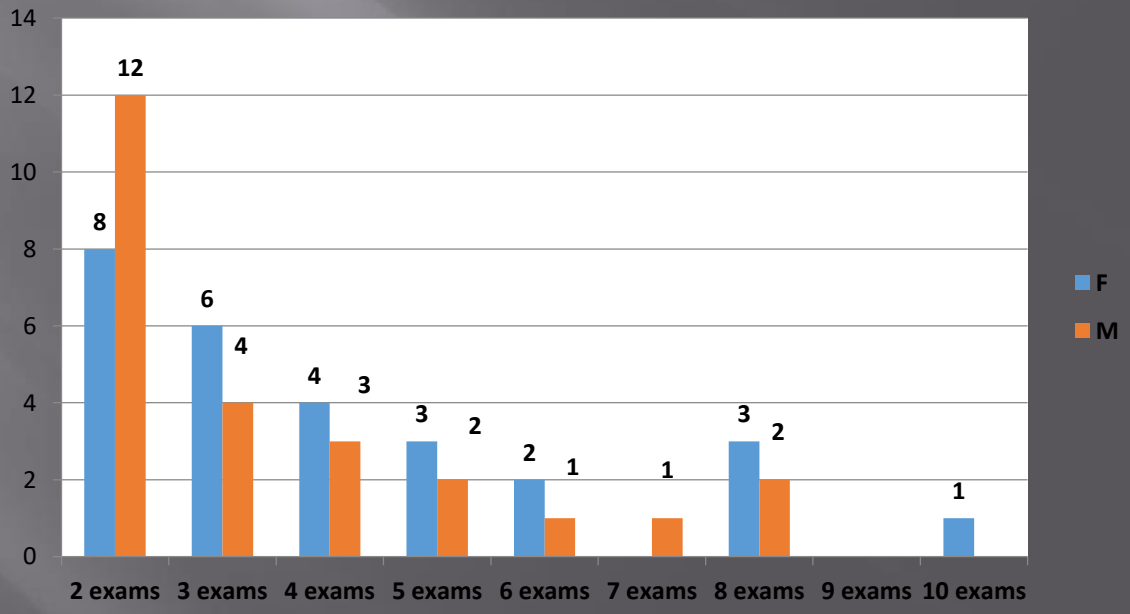
RESULTS

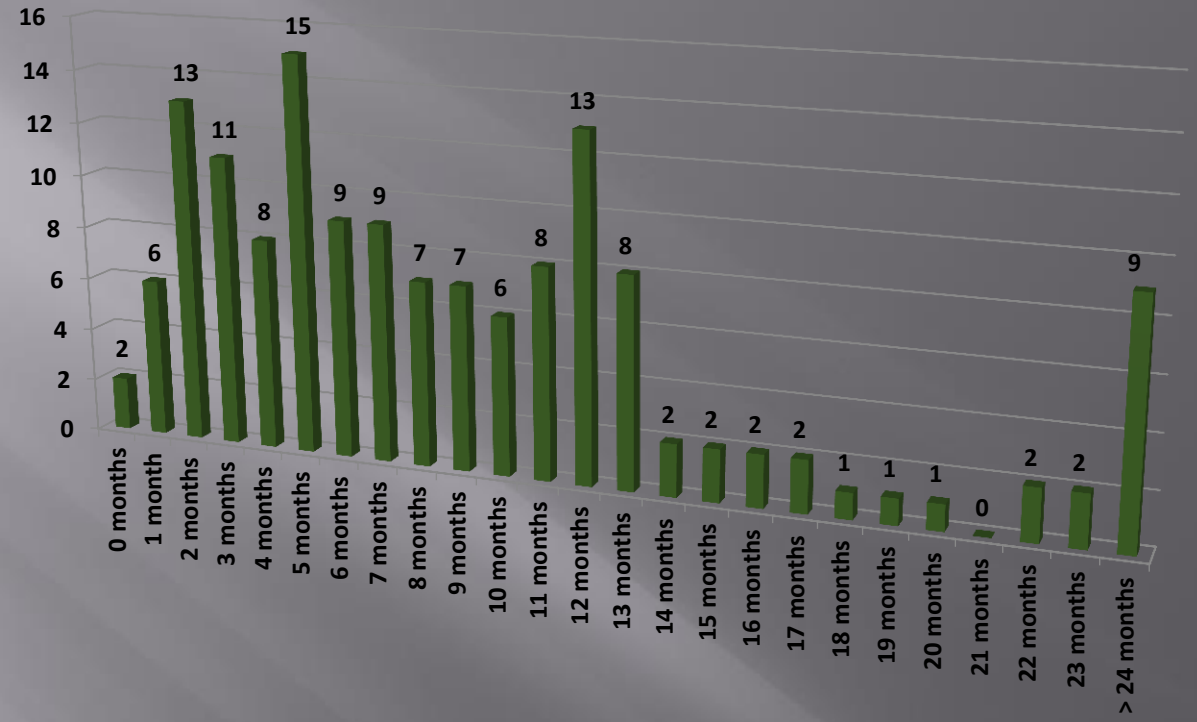
- For the group with recurrent exposure, composed of 27 women and 25 men, the total number of scans was 198 that represent 39.6% from the total exams number.
- All of the patients who performed recurrent exposure received a CED more than 100 mSv.
- Most of the patients from the study are over 50 years old and most frequently are performed only 2-3 exams per patient, but there are also 6 patients who were scanned 8-10 times over a period of 1-5 years.
- A percentage of 57.5% from the total number of exams were performed in time interval of less than one year.



The distribution of patients number depending on the age and gender groups

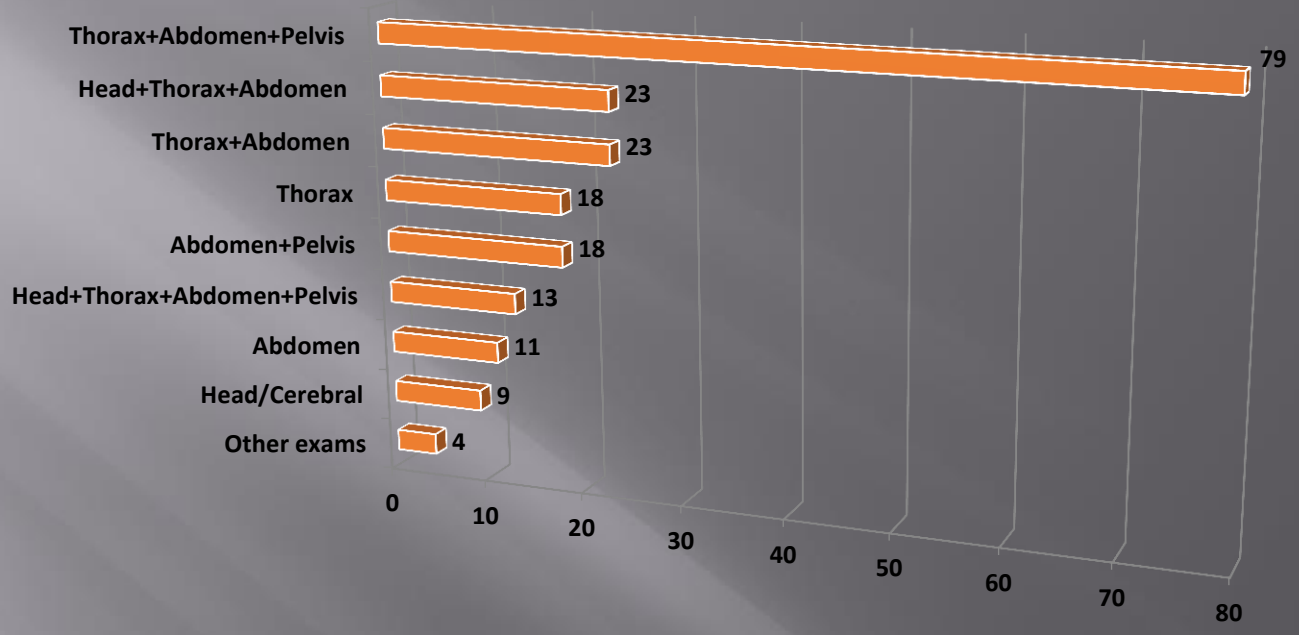
The distribution of patients number depending on the performed exams number





The number of recurrent exams depending on the time interval between consecutive scans, counted for each patient after the first exam performed at Academica Medical Center

Most of recurrent CT exams were performed within an interval of 1 month - 1 year.



The distribution of exams number depending on the investigated anatomical region

Most frequent performed CT exams are trunk scans (thorax-abdomen-pelvis) (39.9%), thorax-abdomen scans and head-thorax-abdomen (11.6%), thorax scans alone and abdomen-pelvis scans (9.1%).

Some clinical cases, patients who received a CED that exceed 100 mSv.

Patient	Gender	Age (year)	Number of performed CT exams and anatomical region	Total time period	CED - (mSv)
Patient A	Male	55	8 exams Head+Trunk	6 years and 5 months	382.63
Patient B	Male	49	8 exams Trunk	2 years and 7 months	345.60
Patient C	Female	74	1 exam Abdomen+Pelvis, 1 exam Head, 6 exams Trunk	2 years	300.90
Patient D	Female	64	3 exams Abdomen+Pelvis, 2 exams Abdomen, 2 exams Thorax+Abdomen, 1 exam Trunk	4 years and 11 months	275.03
Patient E	Female	56	5 exams Head+Thorax+Abdomen, 1 exam Head+Trunk	4 years and 2 months	239.12
Patient F	Male	48	3 exams Trunk	5 months	128.48
Patient G	Male	33	5 exams Thorax	2 years and 6 months	103.35
Patient H	Female	47	8 exams Thorax+Abdomen, 2 exams Head+Thorax+Abdomen	1 year and 4 months	402.78
Patient I	Male	70	5 exams Trunk	1 year	219.13
Patient J	Female	52	8 exams Trunk	3 years and 4 months	357.60
Patient K	Male	58	5 exams Trunk 1 exam Thorax+Abdomen	5 years	256.95

- The age of the patients represent the age at the beginning of the treatment and the CT follow-up.
- These clinical cases were chosen because the CED exceeds 200 mSv, or the time interval between consecutive scans is very short, or the age of the patient is below 50 years.
  - The youngest patient was 33 years old and received 103 mSv in two and a half years.
  - The shortest time period was 5 months for 3 trunk exams with 128 mSv for another patient.
  - The highest CED was 402 mSv and was received by the patient in a short time period – only 16 months

DISCUSSION

- The study confirms the situation of recurrent exposures to ionising radiation presented by the IAEA study, concerning the frequency of CT scans with high values for CED.
- The frequency of recurrent exposure in this small private center is high, taking into account the percent observed in the IAEA study, but in the same time, is justified because, generally, the patients with chronic disease (cancer) follow their treatment's evolution in private clinics much more than in radiological departments of emergency or county hospitals.
- Most of the patients from the study are more than 50 years old, with a peak around 60-70 years old and most frequently are performed only 2-3 exams per patient.
- But, for many patients, the time interval between consecutive scans is less than one year, that means an important radiation dose is received by the patient in a short time interval.
  - The tissues have not enough time to repair the damages caused by the ionising radiations, that could lead to developing of other health injuries.
- Another aspect is regarding the most frequent exam type that is for trunk (thorax+abdomen+pelvis), where the majority of risk organs are located.

CONCLUSION

- The importance of strong justification of every CT scan is more than evident. The physicians need not only referral guidelines for medical imaging as is specified in Council Directive 2013/59/Euratom, but also an electronic system that can provide information about every medical exposure performed by each patient, taking into account the radiation doses.
- To have a real image of CED for every patient from Romania, it is necessary to create an electronic system at national level for individual registration of medical exposures.
- This electronic system must be available to every referrer, from everywhere in the country and the ionising radiation exams must be indicated after a good analysis of information concerning the CED of every patient.
- Regarding the radiation protection of patients, the referrers must analyze, for every patient, the possibility of using non-ionising imaging modalities (MRI, ultrasound) instead of CT exams.
- Taking into account the high values of CED received by the patients as in our study, an optimization of CT exams is needed, by using the concept of diagnostic reference levels.

REFERENCES

- *Summary of the IAEA Technical Meeting on Radiation Exposure of Patients from Recurrent Radiological Imaging Procedures, held 4-6 March 2019 at IAEA Headquarter, VIC, Vienna,* IAEA, Vienna, Austria,2019
  - Retrieved from: https://www.iaea.org/sites/default/files/19/04/rpop-tm_summary_final.pdf
  - Retrieved on: July 7, 2019
- *European Guidance on Estimating Population Doses from Medical X-Ray Procedures,* Radiation Protection No 154, European Commission, Luxemburg, 2008, pp. 23-43
  - Retrieved from: https://ec.europa.eu/energy/en/topics/nuclear-energy/radiation-protection/scientific-seminars-and-publications/radiation-protection-publications
  - Retrieved on: July 10, 2019
- *Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom,* Official Journal of the European Union, Vol.57, 2014, pp. 25-28
  - Retrieved from: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2014:013:0001:0073:EN:PDF
  - Retrieved on: July 11, 2019