

Short Commentary

Radiation Doses to Patients Undergoing Osteosynthesis Procedures

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Short Commentary

Fractures of limbs are most frequent causes of orthopaedic interventions. Especially the older people are exposed to these because of motion disorders and osteoporosis.

Most of orthopaedic surgery interventions are performed under X-rays control to achieve an optimal settings the anatomical details and also some artificial implants, if such are necessary.

Because if that, X-ray units are common equipment in operational theatre where orthopaedic procedures are performed. As a rule they are mobile C-arm units, which are easy available in any time when are necessary.

A consequence of every usage of X-rays an exposure to patient but also to operational medical team [1-3]. They are a number of factors affecting both the patient and staff irradiation.

There are three categories: patient dependent, equipment dependent and procedure dependent factors.

Patient dependent factors include: body thickness in the beam, complexity of the anatomic structure.

Equipment dependent factors include: setting of dose rates in pulsed fluoro- and continuous fluoro mode, last image hold, acquisition, and virtual collimation.

The main procedure related factors are: number of radiographic frames per run, collimation, fluoroscopic and radiographic acquisition modes, fluoroscopy time, wedge filter, magnification, distance of patient to image receptor (image intensifier or flat panel detector), distance between X-ray tube and patient, and tube angulations.

Very important is also the experience of the operator.

In case of patient, this is especially important for the procedures when the primary beam can cover the part of the trunk. Such situation has place in the procedure of osteosynthesis the femoral bone, reconstruction of head of femur and also osteosynthesis the

humeral bone.

Despite a relatively short time of real exposures, doses to patients undergoing these procedures can achieve quite high values: the entrance skin air kerma (here named the "dose") over 80 mGy was also recorded.

Additionally, in practice the primary X-ray beam incident on the same area patient' body making a higher risk of radiation detriments.

The paper presents collection of doses recorded for patients undergoing the procedures of osteosynthesis the femoral bone and the humeral bone during last months in the big university clinic.

Material and Methods

The patients treated in Clinic of Orthopaedy University Clinical, Traumatology and Traumatic Rehabilitation Hospital Military Memorial Medical Academy - Central Veterans' Hospital in Lodz in the period November 2020- February 2021 were the material for the paper. From these the patients undergoing procedure of intramedullary osteosynthesis (named Targon' method) because of limb fractures were analysed and the following data for them were recorded:

- Type of procedure,
- The entrance skin air kerma (here named the "dose"),
- Age and sex.

The procedures were performed under X-ray fluoroscopy control by mobile C-arm unit ARCADIS Varic VC 10 A (Siemens AG Medical Solutions, Erlangen, Germany).

Results

The procedures performed under control of X-rays between 27th November 2020 and 18th February 2021 in Clinic of Orthopaedy University Clinical, Traumatology and Traumatic Rehabilitation Hospital Military Memorial Medical Academy - Central Veterans' Hospital in Lodz were analysed in respect of the doses to patients. The number of such patients in this period was only 52 (34 women and 18 men) because of Covid pandemic limitations.

X-ray control was apply to intramedullary osteosynthesis of long bones both the hands and the legs by Targon' method.

The results of analysis are presented in Table 1.

Conclusions

The data collected in Table 1 suggest that orthopaedic interventions are more frequent for women than for men.

Whereas number of the hand procedures are similar for the both sexes the legs surgeries are definitely more frequent for women than for men.

Table 1: Mean values of doses received by patients undergoing intramedullary osteosynthesis procedures.

Sex	Limb	No. of patients	Mean age [years]	Mean dose \pm SD [mGy]
WOMEN	HAND	7	71.7 \pm 17.7	3.72 \pm 2.50
	LEG	26	79.3 \pm 13.9	9.34 \pm 7.57
		1 ^{''}	91	
MEN	HAND	7	68.9 \pm 15.2	3.91 \pm 2.74
		1 ^{''}	83	22.4
	LEG	9	65.1 \pm 15.3	11.03 \pm 8.34
		1 ^{''}	64	

[']SD: Standard Deviation.

^{''}The doses a few times higher than remaining.

For hand procedures the mean age and mean dose for the both sexes have similar values.

This probably suggest an accidental origin of the hand fractures.

As opposite, the mean age and mean dose also differ visibly for the both sexes:

- Mean age of women is significantly higher in comparison to men,
- Mean doses for women are slightly lower.

The above observations seam suggest that for men leg fractures probably have accidental origin when for women the fractures result from osteoporosis.

Generally, mean doses during leg procedures are nearly three times higher the during hand ones. Additionally should be noticed the cases of really high doses to patients, especially during leg osteosynthesis procedures (70-80 mGy).

The results obtained in the paper have similar raw of quantity as those presented in the paper [4] where the Entrance Surface Air Kerma (ESAK) to patients undergoing Dynamic Hip Screw (DHS) and Dynamic Cannula Screw (DCS) procedures were evaluated. The mean patients' doses were 0.46 mGy and 0.07 mGy for DHS and DCS procedures, respectively.

References

1. Staniszewska MA, Kopec R, Budzanowski M, Owsiak E. Factors affecting exposure level for medical staff during orthopaedic procedures under fluoroscopic control. *Med Pr.* 2017; 68: 75-83.
2. Staniszewska MA. Factors Affecting Doses for Medical Staff in Orthopaedic Procedures Under X-rays Control. *Clin Res Foot Ankle.* 2017; 5: 235.
3. Theocharopoulos N, Perisinakis K, Damilakis J, Papadokostakis G, Hadjipavlou A, Gourtsoyiannis N. Occupational Exposure from Common Fluoroscopic Projections Used in Orthopaedic Surgery. *The Journal of Bone and Joint Surgery.* 2003; 85: 1698-1703.
4. Alzimami K, Habeebballa B, Osman I, Abdelaziz SA, Sassi A, Sam K. Evaluation of occupational and patient radiation doses in orthopedic surgery. *Applied Radiation and Isotopes.* 2015; 100: 65-69.