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CLINICAL SUMMARY

OCCUPATIONAL RADIATION EXPOSURE FROM C-ARM FLUOROSCOPY DURING COMMON ORTHOPEDIC SURGICAL PROCEDURES AND ITS PREVENTION

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BACKGROUND

The authors introduced the rationale for the ensuing study as fluoroscopy use increased dramatically in orthopedics, driven by the popularity of minimally invasive surgeries that offer decreased invasiveness, operative time, and morbidity. However, this trend has also raised concerns about increased radiation exposure to surgeons, patients, and operating room staff.

Ionizing radiation can have biological effects, even at low doses. While some studies have concluded that whole-body radiation doses received during fluoroscopic procedures are well within recommended levels, caution is still warranted due to the long-term risks of even low-dose radiation.

It is important to avoid or minimize radiation exposure whenever possible, even for secondary occupational risks. There are a number of steps that can be taken to reduce radiation exposure during fluoroscopic procedures, such as using collimation to limit radiation spread, shielding, and pulse fluoroscopy.

OBJECTIVES AND METHODS

This prospective three-month study aimed to measure radiation exposure in orthopedic surgeons in India using standard precautionary measures and to raise awareness about the importance of image intensifier safety in their practice. The participants in the study were twelve right-handed male orthopedic surgeons, comprising of three residents, and four and five senior and junior consultants, respectively.

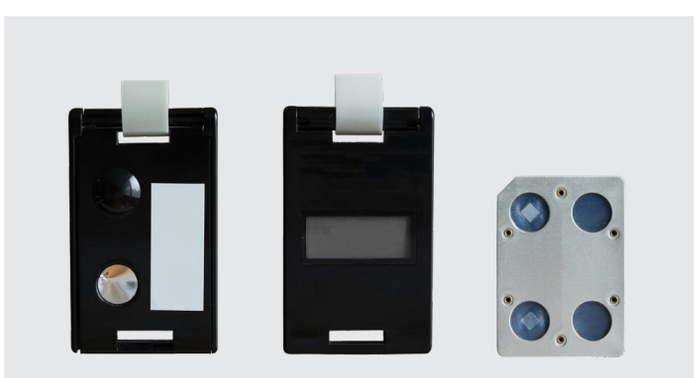

Figure 1: Thermoluminescent dosimeter (TLD) badge

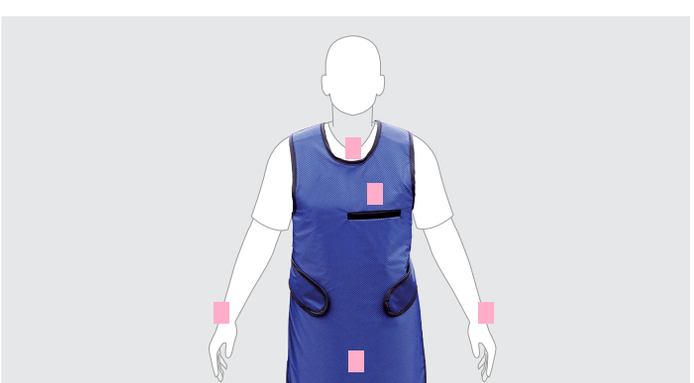

Figure 2: Positioning of the TLD badges

RESULTS

147 procedures were undertaken in which C-Arm was utilized. The mean age of participants was 36. On average, senior consultants were involved in cases that used the C-Arm on nine occasions. Junior consultants and residents were involved in nearly thirteen cases and sixteen cases, respectively. Interlocking nail femur was both the most common and labor-intensive procedure, with an average time of 2:32:33 (hh:mm:ss) hours/case. The maximum mean exposure time was also greatest during this procedure at 0:04:09. The positive correlation between operative and exposure times was significant for all procedures. Exposure time was compared between closed, open and precautious procedures, with significantly higher exposure time during the closed procedures.

Table 1: Difference between exposure times of closed *versus* open *versus* percutaneous procedures

Procedure types	Closed reduction and nailing prcedures	Open procedures	Percutaneous procedures
Mean exposure time per case (hh:mm:ss)	0:03:31	0:02:29	0:01:47
t-value	Closed vs open - 2.27	Closed vs percut - 3.85	Open vs percut - 1.5
p-value	**p<0.05(S)**	**p<0.005(S)**	**p<0.1(S)**

Exposure time and dose for the right wrist (r=0.735, p=<0.01) and left wrist (r=0.58, p=<0.05) exhibited a notable correlation. Overall, it was the dominant hand that received the greatest amount of exposure, very likely because of its closer proximity to the image intensifier and its radiation.

Table 2: Cumulative mean exposure dose to various body parts of all the surgeons
mSv = milli Sieverts, ICRP = International Council of Radiation Protection

Parts	Mean exposure per subject (mSv)	Extrapolated mean annual exposure per subject (mSv)	ICPR limits (mSv)
Neck	0.328	1.312	150
Chest	0.17	0.68	20
Gonads	0.15	0.60	20
Right wrist	**0.73**	2.92	500
Left wrist	**0.58**	2.32	500

CONCLUSION

Occupational exposure to ionizing radiation is imperative to consider in all such cases due to its inherent ability to cause physical damage at the cellular level. This study shows that the senior consultant and assistants extremities are exposed most to radiation.

Radiation is thus to be regarded as an occupational hazard in the operating room, to which everyone is potentially vulnerable. Although the radiation exposure was within ICRP permissible limits, any amount of exposure can be potentially dangerous, with the suggestion that the risk of cancer incidence increases with orthopedic surgeons. As such, safety precautions should be taken, and a dosimeter worn to measure the dose to the body. Safety programs should be instituted to educate all who work in healthcare.

APPLICATION FOR PRACTICE

1

Initial and on-going radiation safety training

2

Ensure understanding and awareness of radiation risk and monitor with a dosimeter

3

Appropriate use of PPE products to reduce radiation exposure

Including, but not limited to:

1. Lead apron
2. Lead thyroid shield
3. Lead glasses
4. Radiation Attenuating sterile surgical gloves

Note: This clinical summary is written by clinicians at Ansell Healthcare Products LLC. Please refer to the actual study for full text information.

Mahajan A, Samuel S, Saran AK, Mahajan MK, Mam MK. Occupational radiation exposure from C-Arm fluoroscopy during common orthopaedic surgical procedures and its prevention. *J Clin Diagn Res*. 2015;9(3):RC01-RC4.

Full text article can be found at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4413121/

For more information or additional clinical resources, please visit: www.ansell.com/AnsellCARES

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