Role of Shielding in Cervical Radiography: Experimental study

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INTRODUCTION

The use of ionizing radiation for the imaging of patients is steadily increasing, as there are more than 10 million diagnostic radiology procedures being conducted every day around the world.

Shielding is one of the fundamental methods to protect radiosensitive organs in patients undergoing conventional radiological examinations. A lack of or inadequate shielding of the **gonads** may increase the exposure to these organs and lead to un-necessary radiation dose (Karami, Zabihzadeh and Gholami, 2016).

The **breast** dose is also concerning because it is close to the primary beam in some radiography examination such as AP cervical spine. In many cases the AP procedures are changed to PA to reduce radiation to the sensitive organs (Andersen, Andersen and van der Kooy, 1982). However it is difficult to preform cervical examination in PA position due to multiple reasons concerning patient and technique.

Furthermore, **eye lens** is an important sensitive organ and it could be affected by low radiation dose on the long term. It is thought to be 2 Gy is the threshold dose but recent findings, showed lens opacification occurrence at significantly lower doses similar to radiation dose from diagnostic and therapeutic examinations(Kleiman, 2012).

AIM

The main aim of this study is to demonstrate the importance of shielding of radiosensitive organs during the AP Cervical Spine conventional radiography examination.

Objective of the study:

- Is to investigate the Entrance Skin Dose (ESD) for **gonad**, **breast** and **eye lens.**
- To determine the role of shielding in dose reduction to **gonad**, **breast** and **eye lens**

METHODS

An experimental study was conducted in April 2019 in the Medical Diagnostic Imaging lab at University of Sharjah in U.A.E.

X ray machine:

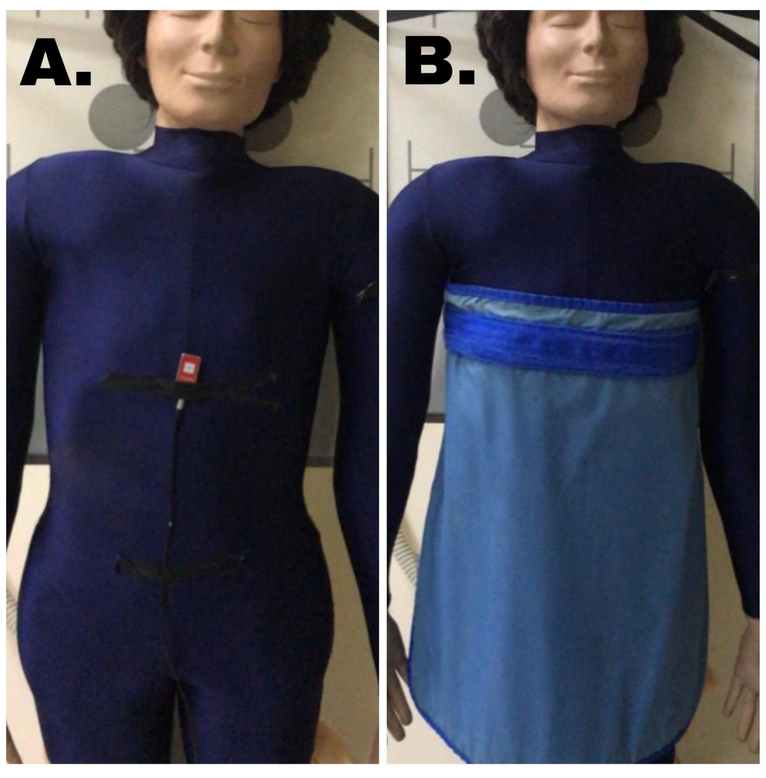
The experiment was done using Philips x ray unit with 2.5 mm Al filtration.

Radiation dose measurement:

ESD was measured using Piranha

Radiographic procedure:

Using an x-ray machine, female phantom and piranha device for dose measurement. the radiography technique was done according to the Millers Atlas of radiographic Positioning and procedures.

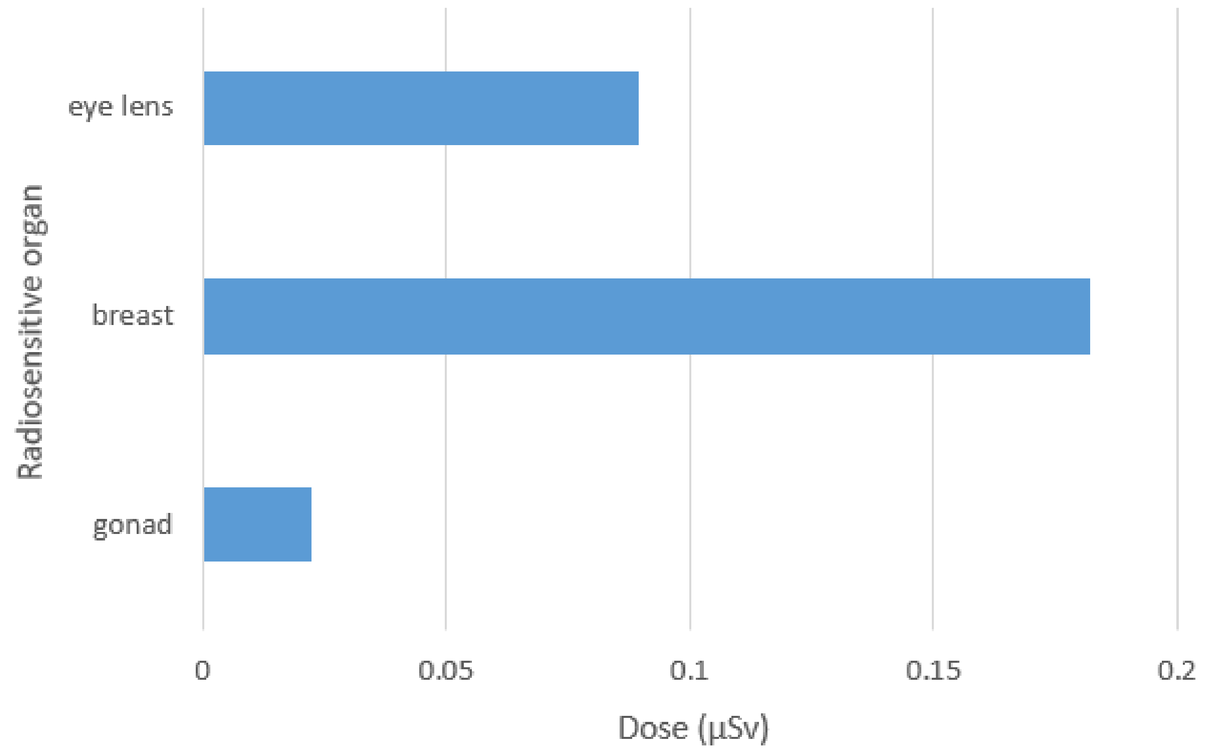


The figure shows the step for the experiment: **A.** AP Cervical Spine erect without shield, the piranha placed at the breast area to measure the breast dose. **B.** AP Cervical Spine erect with shield, the piranha placed below the shield.

The resulted dose is represented as the Entrance Skin Dose (ESD) because the piranha cannot be placed within the phantom there for it will be placed on the surface.

RESULTS

	Gonad		Breast		Eye lens	
Expoure	With	without	With	without	With	without
1	0.0250	0	0.187	0.0041	0.093	0
2	0.0240	0	0.18	0.0000	0.091	0
3	0.0240	0	0.182	0.0041	0.091	0
4	0.0236	0	0.184	0.0043	0.091	0
5	0.0200	0	0.184	0.0039	0.093	0
6	0.0202	0	0.184	0.0000	0.091	0
7	0.020	0	0.181	0.0036	0.091	0
Average	0.02258	0	0.1822	0	0.091	0



This chat represent the Entrance Skin Dose (ESD) measured without shielding and it shows that the breast had the highest measurement (0.1822 µSv) following the eye lens and gonad respectively.

CONCLUSION

There is a measurable the gonad, breast and eye lens for patients undergoing AP cervical spine conventional radiological examination as the results showed (0.02 µSv, 0.2 µSv, 0.09 µSv) respectively. No significant dose was detected for all three organs when the shield was applied (Entrance Skin Dose (ESD) = 0 µSv). This conclude that applying lead shield results in reduction on the overall dose resaved by the body and it protects the radiosensitive organs from scatter radiation which could affect the patient on the long term(Report on Amendments during 1956 to the Recommendations of the International Commission on Radiological Protection (ICRP), 1959). Thus, it is important to apply the shielding during AP cervical spine conventional radiological examination to reduce the radiation dose to the radiosensitive organs and protect them from scatter or unnecessary radiation which could affect them on the long term especially the breast because it is resaving the highest dose.

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