Radiation Protection Effect of Novel Pb Plate in Videofluoroscopic Swallowing Study

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TEACHING POINTS

- Protection of staff exposure during Videofluoroscopic swallowing study using a Original novel Pb shield.

- Radiation protection education for staff using radiation dose map.
Background

• The new occupational dose limit of the crystalline lens was recommended by the International Commission on Radiological Protection (ICRP 118) in 2012.

• Lead shield already exist for use with the bed ‘horizontally’.

• There has never been a lead shield attached to the bed when used ‘vertically’.
Purpose

To investigate the effectiveness of Original novel Pb shield for reducing the scatter radiation during Videofluoroscopic Swallowing Study.
Staff Exposure

Exposure to scattered radiation comes from where?

1. Patient
2. X-ray irradiation port

Knowing the source of scattered radiation

Very important for staff radiation protection education

Original novel Pb shield
(Using Videofluoroscopic Swallowing Study :VFSS)

Original novel Pb shield

‘VFSS shielding plate’

VFSS Shielding Plate use **vertically** in the bed and **attach to the handrail** of the table.
Lead equivalent of 0.3mm Pb, weighs about 6 kg, and is 50cm × 50cm × 8.0mm.
Methods: Phantom study setup

- Measurement plan for this study, X-ray tube, phantom, ‘VFSS shielding plate’
- VFSS shielding plate can be moved up and down according to the physician’s eye level (→)
- Radiation survey meter (ICS-321, HITACHI, ALOCA Medical Ltd. measuring range of 1-300 mSv/h).

Bed: vertical position

Measurement scatter radiation with and without VFSS shielding plate
Measurement Diagram

- X-ray tube - image intensifier: 148 cm
- X-ray tube - entrance surface of the human phantom: 110 cm
- Human phantom - physician’s position: 60 cm
- Measurements at 15 points (black point)
- 50 cm intervals
- 150 cm in height above the floor (Physician’s eye level)

P: physician’s position
Q, R: medical staff position (nurses and speech-language pathologist)
Result: Radiation dose map

<table>
<thead>
<tr>
<th>µSv/h</th>
<th>Without shield</th>
<th>With shield</th>
<th>Reduction rate(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>190</td>
<td>92</td>
<td>51.6</td>
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<tr>
<td>150</td>
<td>52</td>
<td>46</td>
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<td>100</td>
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<td>15</td>
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</tbody>
</table>

**Without shield**

**With shield**

VFSS shielding plate
Use case in clinical

Using ‘VFSS Shielding Plate’ the physician will reach out from under the shield and let the patient eat and drink, so it will not hampere in VFSS.

Setting VFSS Shielding Plate

Physician’s eye level
Conclusion

• ‘VFSS shielding plate’ effectively provided protection from scattered radiation at the physician's position during VFSS (> 50%).

• The protective effect was about 10% at the staff's position. The original scatter dose is low, but staff should keep away from the patient and X-ray tube.

• The radiation dose map can visually confirm the effect of scattered radiation protection and is useful for staff radiation protection education.