Perioperative radiation exposure during combined anterior and posterior surgery in combination with eXtreme Lateral Interbody Fusion (“XLIF®”)

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Background & Purpose

- From 2013 as minimum invasive anterior lumbar inter body fusion XLIF® has been very popular.
- Imaging intensifiers are critical to the XLIF® procedure and posterior instrumentation.
- The negative effect of radiation exposure during the XLIF® procedure is unclear and currently unreported.

Purpose

The study of peri-operative radiation exposure of the operator and paramedical staff in Anterior and Posterior Spinal Fusion with XLIF®

Materials & Methods 1

Materials The following staff were monitored during 18 procedures of degenerative lumbar disease

(1) Operator (OP)
(2) Primary Assistant (A)
(3) Scrub Nurse (SN)
(4) Circulating Nurse (CN)

Method We measured the radiation exposure during anterior spinal fusion (XLIF®) and posterior instrumentation.

18 cases (11 men, 7 women) Average age 71.1y/o (63~78y/o)
Average number of XLIF 2.33discs (1~3)
Average XLIF operation duration 73.8minutes (21～112min)(31.9min/Disc)

Average number of posterior instrumentation 2.61discs (1~4)
Average posterior instrumentation duration 123minutes (60～237min)

(47.7min/Disc)

4 cases of combined XLIF® & TLIF (Distal Interbody Fusion) from the 18 total cases.

2 case of combined XLIF® and posterior direct decompression.

The “Wiltse’s approach” was utilised exclusively for the posterior approach.
To reduce radiation exposure, confirmation of the insertion point was viewed directly followed by dynamic EMG when inserting the screw.

Materials & Methods 2

X-ray measurement
2 pocket dosimeters (PDM-127B-SZ manufactured by Hitachi Aloka Medical, Ltd.) were placed in the breast pocket of both the outer protective garment and inner surgical gown.

wearing protective clothing which fastens at the front to protect the rear surface

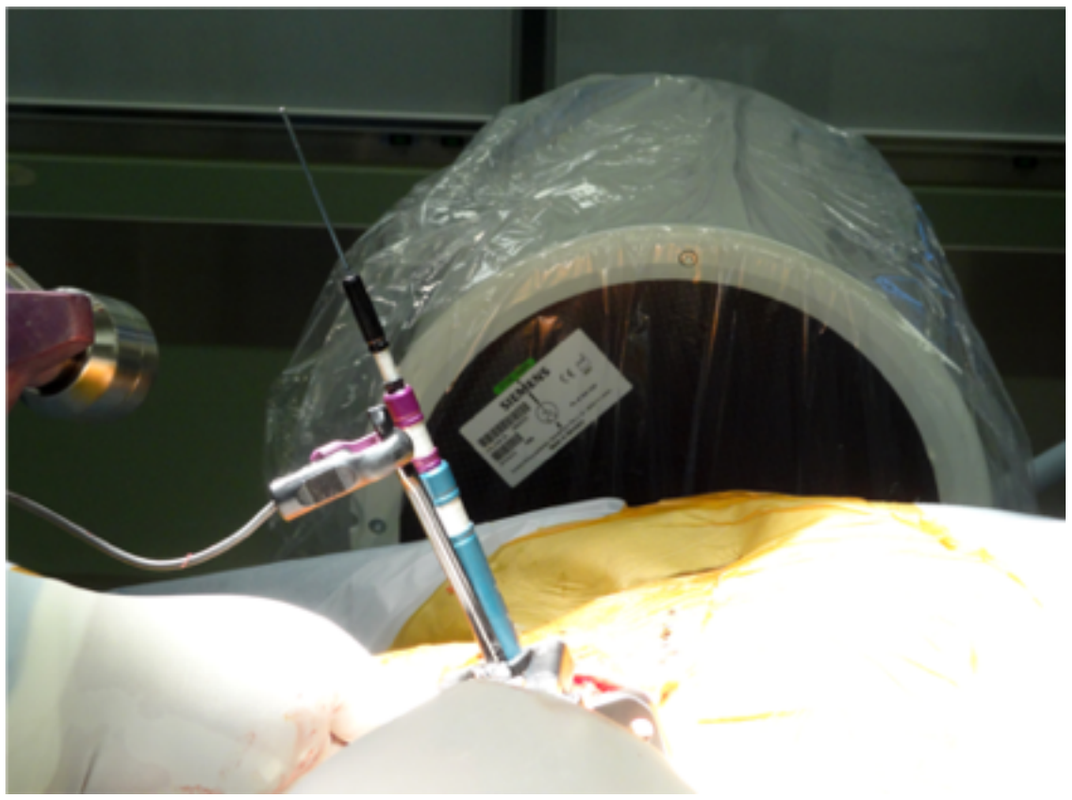
Results The mean radiation exposure dose（μSv)

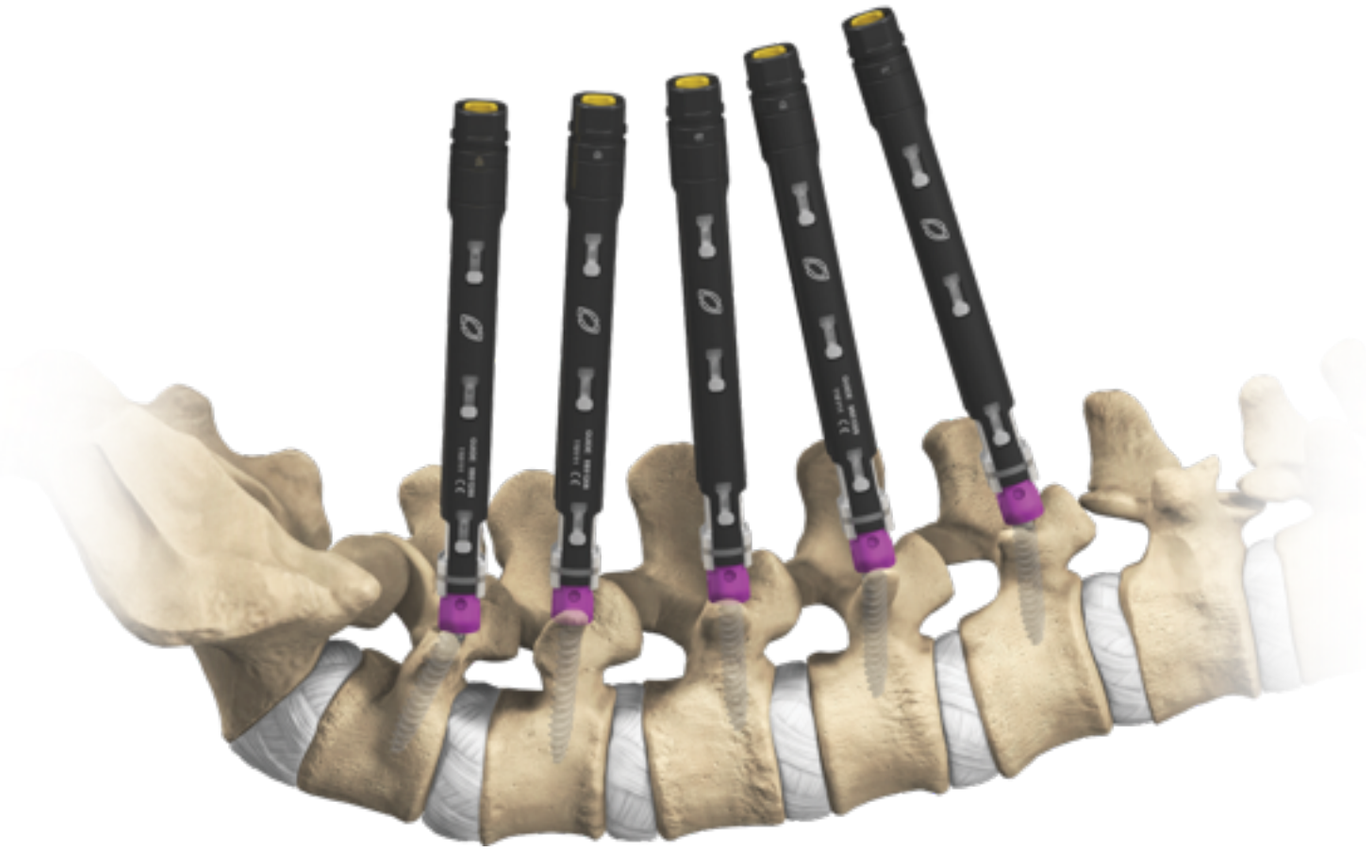
	The exposed surface (XLIF®)	Inside (XLIF®)	The exposed surface (posterior)	Inside (posterior)
O P	32.1 (2-82)	0.78 (0-3)	40.2 (2-154)	1.61 (0-5)
PA	3.83 (0-15)	0.39 (0-2)	10.0 (0-52)	1.67 (0-8)
SN	2.47 (0-11)	0.13 (0-2)	6.67 (0-36)	1.07 (0-4)
CN	0.55 (0-2)	0.17 (0-1)	1.73 (0-4)	0.50 (0-3)

operator (OP), primary assistants (PA), and nurses (scrub nurses [SN] and circulating nurses [CN]

Global daily average to natural radiation exposure is approximately 6.6μSv/day

Discussion 1



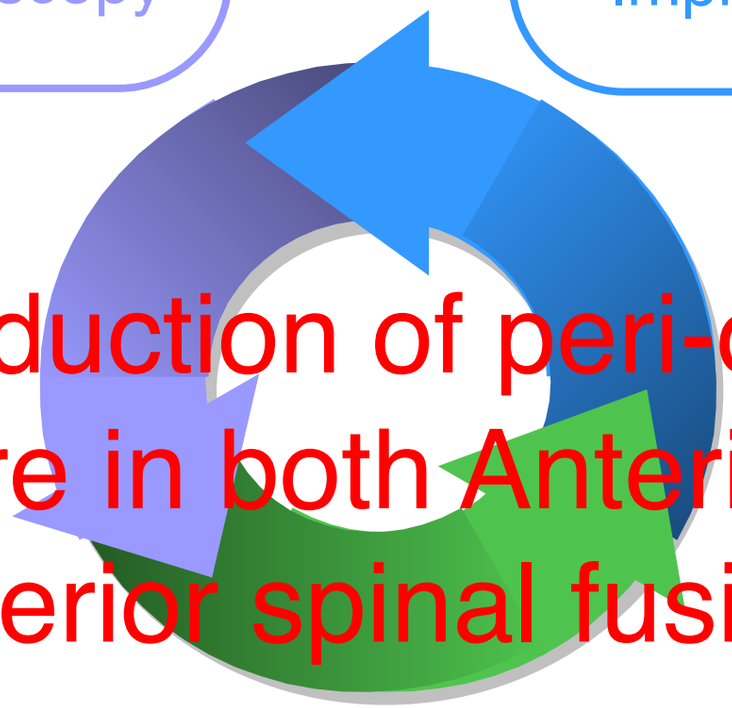


Even though the exposure dose during posterior fusion using “direct line of sight”, dynamic EMG and single fluoroscopy snap shots is considerably lower than the conventional PPS method, it is still higher across all surgical staff than the XLIF® procedure.

Discussion 2

"Snap Shot" Fluoroscopy

Improved PPS method.



Overall reduction of peri-operative exposure in both Anterior and Posterior spinal fusion.

Whole Body Protection

Exposure is considerably higher using the conventional PPS method and continuous fluoroscopy imaging with apron (front) type protection only.

Discussion 3

Discussion

The limit of the effective dose for medical radiation workers.

- 50mSv/Yr and 100mSv/5Yrs
- Female 5mSv/3months
  (during pregnancy ~ delivery 1mSv)

Based on these figures it is possible to perform over 700 operations per year using this procedure.

The limit of equivalent doses

- Eyes 150mSv/Yr
- Skin 500mSv/Yr
- Abdominal exposure during pregnancy 2mSv

This study does not cover radiation exposure of exposed parts,
i.e. Eyes, Hands and Arms.
Further discussion regarding the reduction of exposure to the unprotected body surface of medical workers is required.

Discussion 4

Discussion

Key Points of Pocket Dosimeters

- Many units are required to measure all aspects of each procedure (2 units/staff).
- High maintenance costs to maintain precision.
- Some hospitals are inadequately equipped with pocket dosimeters to capture and record data accurately.

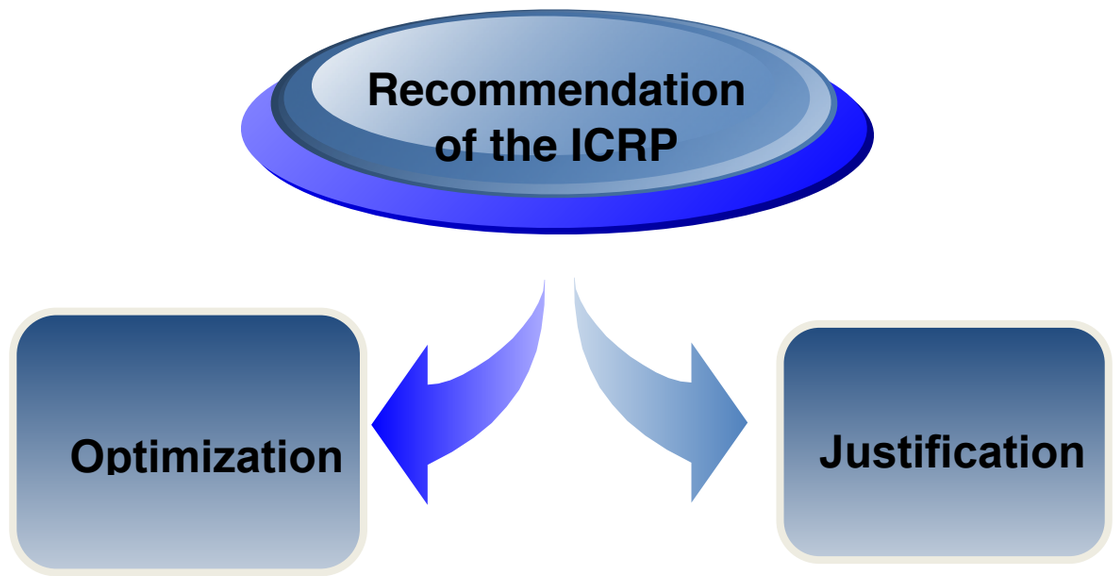
Due to the lack of dosimeters at some facilities there are gaps in the data collection of some staff.

Discussion 5

Discussion

3 principles of radiation protection

- time
- shielding
- distance



- Best effort to reduce exposure levels and minimum number of workers & patients exposed.
- Further reduce the dose of radiation exposure to reduce the stochastic effect.
- Ensure that suitable protective measures are cost effective.

The Radiation Protection Optimisation policy (ICRP)
As Low As Readily Achievable ; ALARA

Conclusion 1

- We reported on our evaluation of perioperative radiation exposure in anterior/posterior surgery with XLIF®.
- With the XLIF® procedure we were able to achieve, on average, more than a **20%** reduction in the exposure dose to exposed surfaces of the OP, than the improved PPS procedure.
- Conventional PPS method exposes all operating staff to much higher doses of radiation than the improved PPS procedure.

Conclusion 2

- The limit of the effective dose for medical radiation workers is 100mSv/5years and 50 mSv/years. The results of this evaluation achieved a sufficiently low-dose exposure, but when taking stochastic and genetic effects of radiation into consideration, it is imperative to make the radiation exposure dose as low as possible.

The authors declare no conflict of interest associated with this presentation.

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