Editorial

A new protective method to reduce radiation exposure

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Radiation protection depends on three fundamental factors: exposure time, distance, and shielding. Ishii *et al.* described a new method for radiation shielding, called Separation between Two Spaces (STS) (1). The basic principle of STS method is a separation of the space around operative table into two spaces using a lead protector: one space contains the patient, operation table, X-ray tube and image intensifier, and the other space is the rest of the operation room. The operators and operative staffs are doing own job in the latter space.

A systematic review published by Matityahu *et al.* summarized the radiation exposure to surgeons during several types of surgeries (spine, hip, femur, tibia, general orthopedic, and trauma surgeries) (2). According to their review, percutaneous vertebroplasty (PVP), balloon kyphoplasty (BKP), and pedicle screw placement result in high radiation exposure. Taher *et al.* reported that the radiation exposure time during lateral lumbar interbody fusion (LLIF) was 88.7 s and that the exposure doses were as follows: gluteal muscle, 0.0231 mSv; axilla, 0.042 mSv; thyroid gland, 0.0219 mSv; eye 0.0264 mSv, and hand, 1.90 mSv (3). Ahn *et al.* reported that the radiation exposure time during percutaneous endoscopic lumbar discectomy (PELD) was 2.5 min and that the doses per operated level were as follows: neck, 0.0785 mSv; chest, 0.1718 mSv; right upper arm, 0.0461 mSv; left ring finger, 0.7318 mSv; and right ring finger, 0.6694 mSv (4). As the International Commission on Radiological Protection recommends that the annual radiation dose of radiation workers should not excess 20 mSv, I believe that the aforementioned doses are sufficiently high for a single operation. Falavigna *et al.* surveyed the members of AOSpine Latin America and reported that thyroid lead protection, lead glasses, and lead gloves were used by 64.2%, 20.2%, and 7% of spine surgeons, respectively (5). This indicates that shielding, which is one of the fundamental factors for radiation protection, is not considered important by spine surgeons because of its cumbersomeness. Therefore, the demand for non-cumbersome shielding is high. As the STS method can be set-up before disinfecting the patient's skin, the surgeons are not inconvenienced during the operation. STS diminished the average radiation exposure doses to the chest and abdomen to less than 1/10 compared to the doses without STS (0.8 and 0.7 μSv, respectively, with STS, and 10.8, and 10.2 μSv, respectively, without STS).

We have some knowledge regarding reduction in radiation exposure (6-8). The key to reduction in radiation dose is the use of pulsed and collimated X-ray beams (6). To increase the distance from the X-ray tube, Funao *et al.* strongly recommended holding the needle of the percutaneous pedicle screw with a long Kocher clamp during fluoroscopic shots, thus achieving lower effective doses to the surgeons (0.06, 0.06, and 0.07 mSv for one, two, and three fusion levels, respectively) during minimally invasive transforaminal lumbar interbody fusion (MIS-TLIF) in combination with the "one-shot fluoroscopic technique" to reduce the radiation exposure time (38.7, 53.1, and 58.5 s for one, two, and three fusion levels, respectively) (9). Even when using a long Kocher clamp, widening of the distance between the X-ray tube and the surgeons is limited. Dissemination of the STS method is expected to further reduce the radiation exposure.

We can also avail technologies that may reduce radiation exposure, such as the operative navigation system, which is frequently used (10). The combination of robotics and telemedicine is a complete solution for radiation exposure to surgeons. As these technologies are expensive, STS can have high cost-effectiveness and convenience for use in all types of operations.

It should be recognized that radiation hazards are an issue for medical doctors and other healthcare professionals, such as operative nurses and radiological technicians. Minimally invasive spine surgeries (MISSs), such as PVP, BKP, LLIF, PELD, and MIS-TLIF, particularly require the use of fluoroscopy. The protection system described in Ishii's article may contribute to further developments in the field of MISS.

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Footnote

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