

# Radiological Safety

## Current Practice and Recommendations for Gonadal Shielding in Pediatric Radiography

Authors: Aditya Karandikar MD, R1 Radiology Resident, Gauravi Sabharwal MD, Pediatric Radiologist, Henry Ford Health System, on behalf of the MRS Radiation Safety Committee

Introduced in the 1950s, gonadal shielding was widely recommended as a means of limiting heritable genetic effects from medical exposures to ionizing radiation. The policy was well-intentioned and based on the era's understanding of ionizing radiation and its biological effects on germ cells. With a contemporary evidence-based approach, however, gonadal shielding is no longer "justified as a routine part of radiological protection [1]."

Studies have documented the increased incidence of heritable genetic effects in fruit flies and mice after significant radiation exposure though "studies of human descendants of individuals exposed to high levels of radiation (e.g., atomic bomb survivors and individuals exposed to therapeutic medical radiation) have not demonstrated with statistical significance the occurrence of heritable genetic effects [2]." Current prevailing science acknowledges the "possibility of genetic effects, but not at the magnitude that was previously estimated [1]." As a related concept, though not directly related to heritable genetic effects, the tissue weighting factor for gonads was reduced from 0.20 to 0.08 in 2007 while those of other abdominal and pelvic organs remained "essentially unchanged or minimally decreased [3]." In addition to advances in scientific understanding, three key technological developments since the 1950s also support the contraindication of routine gonadal shielding: increased x-ray beam filtration, improvements in x-ray generators, and faster image receptors [4]. These developments together have dramatically reduced gonadal dose during diagnostic imaging by up to 95% as compared to the doses delivered in the 1950s [5].

A few other factors also merit consideration when advocating for the discontinuation of routine gonadal shielding. One of these is the nearly ubiquitous use of automatic exposure control (AEC) in the imaging of patients over the age of 3 years [6]. AEC is the standard of care in these patients because it minimizes errors due to manual manipulation of imaging technique. Gonadal shielding can have the unintended effect of increasing exposure time – which translates to increased radiation dose – if the AEC detector is covered. The American College of Radiology, American Society of Radiologic Technologists, and the American Association of Physicists in Medicine are all in agreement in recommending against the use of gonadal shielding in conjunction with AEC [1]. Instead of gonadal shielding, the best practice of collimation can be utilized to decrease both gonadal and overall dose when appropriate.

Another factor worth considering is the anatomy and variation of gonadal location which makes effective shielding difficult. Females pose a challenge since the ovaries are "not visible and may be located anywhere in a large area within and occasionally outside of the pelvis [7]." The internal location of the ovaries also leads to a substantial increase in the scatter-related dose they receive. Scatter-related dose is essentially unblocked by surface shields as most scatter results from non-attenuated x-rays which are intended to regionally bypass shielding for the sake of diagnostic imaging. Regarding males, younger patients pose some difficulty with appropriate positioning due to the relatively higher location of the testes. The possibility of unknown retractile, inguinal testes or undescended testes can further complicate gonadal shielding [1]. [Continue reading.](#)