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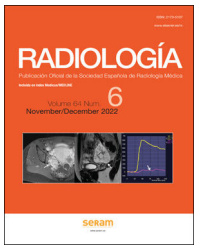

BRIEF REPORT

The future role of forensic radiology — scope and challenges

El papel de la radiología forense en el futuro: alcance y desafíos

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Forensic medicine has been serving humanity for centuries by utilizing medical knowledge for law enforcement. It is a multi-disciplinary field that combines forensic pathology with radiology. Forensic medicine first utilized X-rays in the post-houmous location of bullets in 1896. The principal application of radiology in forensics was to study the skeleton. However, advanced imaging techniques can also examine soft tissues and thoracic and abdominal organs. These techniques, including computed tomography (CT), multi-detector computed tomography (MDCT), and magnetic resonance imaging (MRI), were incorporated.[1,2]

Forensic medicine aids medico-legal investigations and prosecution. It focuses primarily on postmortem examination, i.e., finding the cause and mode of death. Identifying wounds and weapons, mechanisms, and extent of injury extend to living victims. Also, it helps with age estimation. This branch of radiology has also found use in mass disaster calamities, assessment of non-accidental injuries such as child abuse, documentation of fractures and wounds, estimation of age, racial and gender discrimination, and craniofacial reconstruction.[1] Despite its importance, it needs to be better sought after by healthcare professionals.

Applying two- and three-dimensional radiological views for postmortem assessment (MDCT and MRI) allows forensic radiologists to detect distinct abnormalities, occult diseases or injuries, and anatomic areas being difficult to assess by traditional dissection. Detection of gas collections such as pneumothorax, air embolism, and cardio-respiratory support device positioning is more convenient and time-saving than traditional practices.[3]

The macabre nature of the images captured during the autopsy has been controversial and is deemed provocative and harmful by the judiciary.[4] The juries have appreciated input from forensic imaging techniques in the court of law. Three-dimensional MDCT images have been extensively employed as court proofs and facilitate the trial by speeding up the judicial process.[2] Certain cultural and religious beliefs introduce reluctance to seek traditional autopsies for investigation. Postmortem CT and MRI could provide an alternative investigation technique. Forensic radiology can help identify victims in mass fatality incidents such as bomb attacks and plane crashes.[5,6] It also ensures the safety of

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forensic pathologists by avoiding exposure to infectious diseases, explosives, or sharp articles.[2]

Postmortem radiological imaging is routinely used in high-income countries (HICs) such as Switzerland, America, Japan, and Europe. However, the availability and utilization are inconsistent due to accessibility and ease of incorporation with the conventional autopsy workflow.[4] Lower middle-income countries (LMICs) have lower utilization of forensic radiology. Forensic radiology and clinical radiology are significantly different. There is a need for awareness regarding the specialty. The unavailability of standardized postgraduate training in forensic radiology compounds this problem.

Postmortem imaging evaluation requires familiarity with the changes in the body after death. The correct identification of the cause of death requires the investigator to be aware of postmortem tissue structure changes, decomposition-associated gas accumulation, and distribution, and variations due to corpse positioning, requiring relevant and specialized training. Using ultrasound-guided minimally invasive autopsies can reduce uncertainty about specific causes of death and the burden on the coroners.[5] The costs of dedicated resources and trained personnel are high in LMICs. The application of postmortem CT (PMCT) is limited by the available infrastructure and trained forensic radiologists.[4]

The coronavirus disease 2019 (COVID-19) pandemic has strained the healthcare system. With traditional autopsy (TA), exposure to body fluids increases the risk of transmission of infectious diseases like COVID-19. The application of virtual autopsy (VA) using radiological modalities could minimize the spread of infection. CT and MRI are preferred over X-ray and conventional autopsy for postmortem diagnosis of COVID-19. However, implementing forensic radiology in LMICs would require a significant financial commitment. This will ultimately ensure the delivery of safe and objective medico-legal evidence.

A widescale implementation of forensic radiology requires awareness of the importance of the field among the medical community, judiciary, and law enforcement authorities. VA should be preferred and promoted over the TA, and coroners should favor radiological investigations over TA. Accredited institutional training in forensic radiology is needed to train and generate experts in the field. Medical schools should encourage medical students to pursue it as a career. Investment from the government and private healthcare sectors is the need of the hour for developing infrastructure and human capital in forensic radiology. This strategy will ultimately reduce the burden on the healthcare system.

Authors' contributions

M.J.T and Z.Y conceived the idea, S.A, W.T, M.J.T., Z.Y, and M.S.C performed a literature review and wrote the manuscript. Z.Y, M.S.A, and M.J.T. reviewed the manuscript and critically revised it to the final form. All authors approved the final version of the manuscript.

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Conflicts of interest

The authors declare no conflict of interest.

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