Radiology and Forensic Medicine

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Learning objectives

To illustrate role of radiology in forensic medicine and the important data that help radiologists in correlation with forensic physicians.

Background

Radiology represents an important field in Surgery, Internal medicine, Cardiology and Traumatology, in addition to Forensic Medicine. Within the last few decades, there have been significant progress in radiology and medical imaging, which has found solutions to those problems which were classified as difficult or either impossible. Radiographic examination has the ability to solve a lot of problems in forensic medicine investigations, for example gunshot injuries.

Imaging findings OR Procedure details

Radiology and Forensic Medicine

Introduction

Radiology represents an important field in Surgery, Internal medicine, Cardiology and Traumatology, in addition to Forensic Medicine.

Within the last few decades, there have been significant progress in radiology and medical imaging, which has found solutions to those problems which were classified as difficult or either impossible.

On 23 April 1896, exactly a few months after Roentgen's paper had appeared in Nature, Mrs. Hartley was the first firearm victim imaged by X-ray (as a case of forensic medicine).

Radiographic examination has the ability to solve a lot of problems in forensic medicine investigations, some of it will be mentioned in following slides.

- Forensic Radiology in Human Body

  1. A. Radiology and foreign bodies

Radiology can help in: 1- detection, 2- localization, 3- play role in surgical removal.
The industrial worker sustained an accidental stud gun injury of the parietal head. The nail could be removed without difficulty. (Fig1)

1. **B. Radiology and gunshot**
2. plain x-ray and gunshot detection (Fig2)
3. CT and intracranial hemorrhage due to gunshot injury (Fig3)
4. 3D reconstruction shows pattern of skull fracture and comparison with autopsy (Fig4)
5. Facial wound: Detection of cutaneous and bone injuries by CT (Fig5. Mandibular Fracture)
6. Bullet trajectory and Associated lesions (Fig 6. hemopericardium and hemothorax)
7. Detection of perforating bullets in multiple tiny bullets gunshot injury (Fig7. Only one bullet was perforated the right temple and both cerebral hemispheres)

**Radiology and mass disasters and aircraft**

Radiology is very useful for personal identification in mass disasters and aircraft accidents. (Fig8. The victim could be identified by comparison of ante mortem and post mortem radiography)

**Radiology and Identification**

1. Personal identification by past x-ray

Fig8. (a) Ante-mortem chest radiograph showing small cysts in the medial end of the clavicle. (b) Radiograph of excised clavicle showing identical appearances.

2. Personal identification by past medical history

Fig10. Past history of gastro-esophageal removal with a colonic sugary

Fig11. Past history of Multicystic kidneys

Fig12. Past history of pulmonary metastasis

**Radiology and traumatology**

Radiology has a significant role in detection and survey of traumatic injuries obviously. For examples fractures (recent or old), compression fractures and etc.

Fig13. Multiple craniofacial fractures.

**Radiology and child abuse**
Role of the Radiologist

The ability to identify child abuse constitutes an important concern to those involved in the medical care of children. Studies show that at least 10% of children under 5 years old who are brought to the emergency room with alleged accidents have actually suffered nonaccidental trauma. Since as many as 65% of all abuse cases are initially seen in the emergency room, the first step in correctly identifying abuse is to train hospital staff members to recognize abuse indicators. The wide range of findings, which can mimic other disease processes, results in misdiagnosis of many cases of inflicted head trauma. Jenny and colleagues reported that 31% of confirmed abusive head trauma cases were missed on initial presentation and many infants sustained additional injury because of the delay in diagnosis.

The radiologist can be the first to suggest the diagnosis on the basis of CT studies performed to evaluate for seizures or other neurologic symptoms or on X-rays performed for other reasons. A high degree of suspicion, inability to explain the degree of injury or a reported mechanism of injury that is inconsistent with the physical findings should alert the radiologist to possible inflicted injury. A protocol for imaging in suspected abuse should be present to provide high quality radiographs. The future safety of a child with the shaking infant syndrome rests on the radiologist's ability to recognize these characteristic features.

Fig 14. Shaken infant syndrome

Fig 15. Typical corner fracture very specific for non accidental trauma

Fig 16. LEFT: Child evaluated for soft tissue mass in costochondral region. Soft tissue swelling (yellow arrows), chondral part of rib (red arrow) disrupted from bony part (orange arrow) of rib. RIGHT: Initial chest film was negative. Chest film 2 weeks later showed fractures.

Fig 17. Pancreatic laceration in child abuse

Fig 18. from Maxeiner H. Demonstration and interpretation of bridging vein ruptures in cases of infantile subdural bleedings.

- Radiology and electrical injury

One of the important sign in electrical shock is thrombosis of renal artery and occlusion of renal artery in abdominal aortic angiography.
Electrical injury results from the conversion of electrical energy into heat.

- **Radiology and Burns**

  Bronchial filling up could be seen in CT scan. (Fig18)

- **Radiology and drowning**

  1. Diffuse pulmonary edema in a case of drowning (Fig20)
  2. Air-fluid levels within paranasal and maxillary sinuses (Fig21)
  3. Endotracheal and endobronchial froth filling up (Fig22)

- **Radiology and Hanging**

  1. Incomplete hanging: fracture of the right greater hyoid horn (Fig23)
  2. Incomplete hanging: fracture of the right superior horn of the thyroid cartilage. (Fig24)

- **Radiology and high technology**

  1. Radiologist can make imaginary informations by computeric devices.(Fig 25)
  2. Reconstruction of human faces (Fig26)

Make 3D reconstruction millimeter sections of dead face and invention of real human face by computer.

- **Radiology and virtual autopsy?**

  Extremely recent science.

  Whole CT or MRI of dead body instead of real autopsy. (Fig27)

  Virtual autopsy will become the standard autopsy in 21th century.

  Virtual autopsy is dominant conception of the traditional autopsy and postmortem imaging.

- **Radiology : Terror and Terror Prevention**

  The use of radiation imaging for border control. Hermann Vogel(Fig28)

  Control:
• Persons (Fig 29)
• Luggage
• Goods
• Cars, trucks, containers

Illegals" verborgen in einem Container gefüllt mit Bananen. Grenze USA-Mexiko. Röntgendurchleuchtungsbild. (Fig 30)

"Stow aways" Bananen und Menschen. People trying to cross the borders illegally.

**Images for this section:**

![Radiology and foreign bodies](image1.png)

**Fig. 1:** Radiology and foreign bodies

![Plain x-ray and bullet detection](image2.png)

**Fig. 2:** Plain x-ray and bullet detection
Fig. 3: intracranial hemorrhage

Fig. 4: pattern of skull fracture
Fig. 5: Detection of cutaneous and bone injuries by CT
Fig. 6: Radiology and drowning

Fig. 7: Radiology and drowning
Fig. 8: Radiology and drowning
Fig. 9: Radiology and Burns
Fig. 10: Radiology and Hanging
Fig. 11: Radiology and Hanging

Fig. 12: Radiology and high technology
Fig. 13: Radiology and high technology

Fig. 14: Radiology and virtual autopsy
Fig. 15: Radiology: Terror and Terror Prevention

Fig. 16: Radiology: Terror and Terror Prevention
Fig. 17: Bridging vein ruptures
Fig. 18: Pancreatic laceration in child abuse
**Fig. 19:** Bullet trajectory and Associated lesions
Fig. 20: Detection of perforating bullets in multiple tiny bullets gunshot injury
Fig. 21: personal identification in mass disasters and aircraft accidents

Fig. 22: Personal identification by past x-ray
Fig. 23: Personal identification by past medical history

Fig. 24: Personal identification by past medical history
Fig. 25: Personal identification by past medical history

Fig. 26: Multiple craniofacial fractures
Fig. 27: Shaken infant syndrome
Fig. 28: Typical corner fracture

Fig. 29: Evaluation of child abuse
Fig. 30: Radiology : Terror and Terror Prevention
Conclusion

According to great progress in radiology and medical imaging and high ability of radiologic examination to resolve forensic problems, it is important that radiologists recognize how they can help to forensic physicians.

Personal Information

References