Grand Rounds Vol 14 pages L3–L4
Specialities: Landmark case report
Article Type: Case Report
DOI: 10.1102/1470-5206.2014.L002


# The discovery of a bullet lost in the wrist by means of roentgen rays: Robert Jones

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Date accepted for publication 18 June 2014

## Abstract

In 1896, Robert Jones submitted the first publication reporting a radiograph of a bullet seen inside the human body. A 12-year-old boy shot himself in the left hand "just above the left palmar arch". The bullet, a lead pellet, could not be found on enlarging the wound and it was "thought injudicious to prolong the search" given the "important structures in the vicinity". Professor Oliver Lodge used Roentgen rays to image the wrist and the bullet was clearly identified at the base of the 3rd metacarpal. It was thought to be sitting in the articular surface between the base of the 3rd metacarpal and the capitate, or "os magnum" as it was referred to. At the time it was quoted as being the first radiograph, or photograph, of a bullet embedded in a wrist. Before the Roentgen ray, this child would have either required extensive exploration or the foreign body would have been left in situ. The chosen imaging technique and outcome would not differ between what was published in the *Lancet* on 22 February 1896 and what happens currently in 2014, 118 years on. The absorbed radiation dose of the Roentgen ray in this case in 1896 was 12,500–25,000 times greater than it is today.

## Keywords

Roentgen ray; X-ray.

## Case report

In 1896, Robert Jones submitted the first publication reporting a radiograph of a bullet seen inside the human body. A 12-year-old boy shot himself in the left hand "just above the left palmar arch". The bullet, a lead pellet, could not be found on enlarging the wound and it was "thought injudicious to prolong the search" given the "important structures in the vicinity". Professor Oliver Lodge used Roentgen rays to image the wrist and the bullet was clearly identified at the base of the 3rd metacarpal. It was thought to be sitting in the articular surface between the base of the 3rd metacarpal and the capitate, or "os magnum" as it was referred to. At the time it was quoted as being the first radiograph, or photograph, of a bullet embedded in a wrist. The intention was to remove the bullet but the author was waiting for the inflammation to decrease first.

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First, short exposures identified that the bullet was not in the soft tissues, then the wrist itself was imaged, made difficult by the opacity of the bones. He used a Ruhmkorff coil powered by five storage cells. By using a home-made vacuum tube and a magnet, he converged the cathode ray onto a piece of glass, which phosphoresces and acts as the source of the x-rays. An Edwards isochromatic plate 23 cm from the vacuum tube was shielded from light by sheet aluminium and used as the sensor plate. The boy's wrist was sitting against the plate palm down and the exposure time was greater than 2 h. The result showed the bullet in the wrist as previously described.

This certainly changed practice for the better. Before the Roentgen ray this child would have either required extensive exploration or the foreign body would have been left in situ. Exploration would have been painful, potentially damaging to local structures such as the median nerve or flexor tendons, and may have resulted in infection and significant morbidity. Leaving the foreign body in situ would certainly have lead to arthritis, with significant pain and dysfunction.

What the authors have done in this instance is take dorsal-palmar and lateral plain film radiographs in order to identify a metallic foreign body in the wrist. Although the lateral films are not shown in the article, the author did take short exposures to ensure the bullet was not in the soft tissues. This is very similar to what we would do today[1]. It would be called an x-ray and radiograph instead of Roentgen ray and photograph. The lateral image would include the bones, looking for fractures. To this day, we continue to take dorsal-palmar views to avoid confusion on which hand is imaged, unless doing a special plantarodorsal view for example in rheumatoid arthritis, and the bones would be scrutinized for fractures. The chosen imaging technique and outcome would not differ between what was published in the *Lancet* on 22 February 1896 and what happens currently in 2014, 118 years on.

Calculating the dose of radiation absorbed by this patient is difficult. Estimations of radiation from Roentgen rays in 1896 vary. A dental radiograph taken 14 days after the announcement of the discovery of Roentgen rays with an exposure of 25 min resulted in hair loss to the side of the head imaged[2]. This radiograph was assessed as having an absorbed dose less than 300 rad as there was no skin blistering. Dr Stickney reported on one patient undergoing abdominal imaging, who had a total exposure time of 1 h 25 min, resulting in skin burns and later surface slough[3]. Dr H.D. Hawks did 4 days of demonstrations with a Roentgen ray and developed deep skin burns[4]. William Levy, who had been shot in the head 10 years previously, experienced severe swelling, soreness and bleeding after intermittent exposures over a 14-h period[5]. These three, all from 1986, reported skin blistering so it is assumed that they were exposed to greater than 1500 rad. Robert Jones did not report any blistering, so it is not unreasonable, given these other cases, to deduce that the patient had an absorbed dose of less than 300 rad. Likewise, as stated above, intermittent exposures between 1 h 25 min and 14 h, and 4 days of short exposures, resulted in absorbed doses greater than 1500 rad. To assume the absorbed dose in this instance is close to 300 rad is not unreasonable; hence a dose of 150–300 rad. Of course, this is all estimation given the different strength of rays and distance from the source. Assuming the absorbed dose was between 150 and 300 rad, that equals 1.5–3.0 Grays (Gy). A wrist x-ray in modern practice has an absorbed dose close to 0.12 mGy[6]. Thus, the absorbed radiation dose of the Roentgen ray in this case in 1896 was 12,500-25,000 times greater than it is today.

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