

The importance of CT imaging for detecting traumatic intraorbital and maxillofacial foreign bodies

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Abstract

The study represents an evaluation of the ability of spiral and conventional computer tomography in the diagnose of intraorbital and intraocular foreign bodies.

The study includes 19 patients, aged between 15 and 52 years, 10 men and 9 women, presenting intraocular or intraorbital foreign bodies or as a result of an traumatic injuries, who addressed the Emergency Hospital N. Oblu Iasi, between September 2010 - March 2011. The CT examination was the main imaging method of investigation in addition to conventional radiographs; it was conducted on a Philips Aura single-slice unit and a Siemens SOMATOM AR.C unit in the Department of Radiology and Medical Imaging in the Hospital “N. Oblu” Iasi.

One patient presents an CT image of carbonite IOFB, 5 patients present metallic IOFB, the images are obtained using used incremental CT (Somatom ARC, Siemens). 2 patients present

spiral CT image of a metallic penetrating intraocular foreign body, 11 patients present spiral CT image of a metallic penetrating intraocular and maxillofacial foreign body.

The classical computer tomography and

spiral CT are among the most effective methods of examination and management of intraocular foreign bodies, maxillofacial or intraorbital.

The spiral CT realise a continuous scanning of a volume of the patients body during table movement and reduces examination time and radiation exposure.

Keywords: computertomography, IOFB, orbit

Introduction

Intraorbital foreign bodies (IOFBs) are a common occurrence worldwide and happen at a frequency of once in every six cases of orbital trauma. Metallic foreign bodies are more frequent than organic, carbonite or glass IOFB (1, 2). Imaging and management should be tailored individually.

The intraorbital foreign bodies represent a medical emergency due to major problems caused by complete/ partial loss of vision.

The importance results also from the high price of the treatment and of the difficult rehabilitation of the patients.

The purpose of the study is the comparative evaluation of the results of

incremental CT scan comparing to spiral CT.

CT is generally considered to be the gold standard for IOFBs. It is safe to use with metallic IOFBs, excludes orbito-cranial extension, and is also able to diagnose orbital wall fractures and orbital sepsis with high accuracy. Abscess formation in the orbit, bone, and brain are other complications that CT may exclude.

Spiral CT reduces artifacts from metallic intraorbital foreign bodies, also reduces patients irradiation and the images obtained are higher quality than those from the conventional CT.

CT is also accurate for the detection and localization of glass, metal, and stone

foreign bodies, and the nature of the IOFB may be deduced from the Hounsfield numbers.

Metallic density is easily distinguished on CT, but size overestimation of metals on soft tissue window settings is a well-recognized occurrence. The CT threshold size for the detection of metallic foreign bodies is 0.07 mm³ with thin slice CT, method is lower sensitivity in case of radiolucent foreign bodies, or where they are located near the sclera (1, 2, 3).

CT is useful in case of complex orbital trauma, allowing visualization of soft tissue, bone structures and intraorbital foreign bodies.

Advantages of CT examination for are important for complex trauma, in case we have an association of a head injury and orbital, intraocular foreign bodies and the possibility exam the vascular using the contrast substances.

Material and method

The study includes 19 patients, aged between 15 and 52 years, 10 men and 9 women, presenting intraocular or

intraorbital foreign bodies or as a result of an traumatic injuries, who addressed the Radiology and Ophthalmology departments of the Hospital "N. Oblu" Iasi, between September 2010 - March 2011.

The CT examination was the main imaging method of investigation in addition to conventional radiographs; it was conducted on a Philips Aura single-slice unit and a Siemens SOMATOM AR.C unit in the Department of Radiology and Medical Imaging in the Hospital "N. Oblu" Iasi.

The examination protocol was different depending on the apparatus used: the device Siemens have used sections with a thickness of 3 mm and reconstruction at 3 mm, and on the Philips it could have spiral acquisitions, usually with 2 mm sections, pitch of 3 mm (1.5) and reconstruction at 1 mm.

The examination was native, depending on clinical indications and the native exam results, contrast was sometimes given intravenously (Iopamiro, Bracco - Ewopharma, Ultravist, Schering, Omnipaque, GE - Amersham). Routine were performed 2D reconstruction (MPR - "multiplanar reconstructions" or MIP - "maximum intensity projections") and sometimes 3D reconstruction (SSD - "Surface shaded display "DVR-" direct rendering volumes").

Were usually performed section in the axial plane, but for the pathological lesions that affect the orbital floor or ceiling were made direct coronal sections.

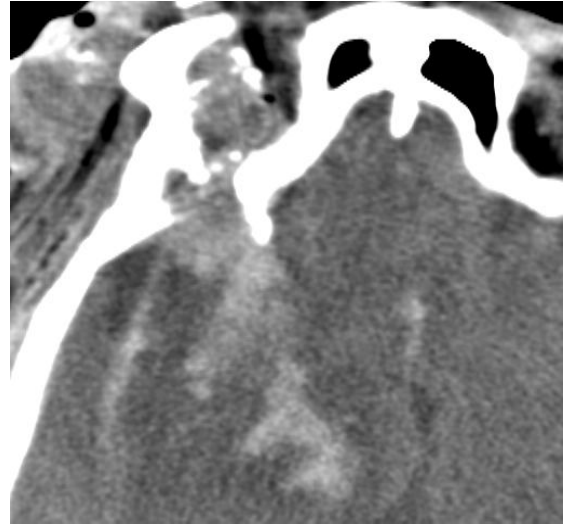
The opportunity to evaluate fast and very precise the bone and soft tissue damage (orbit, superficial, endocranial) made this method to be preferred for cranio-facial trauma patients, making often in the first line.

Results

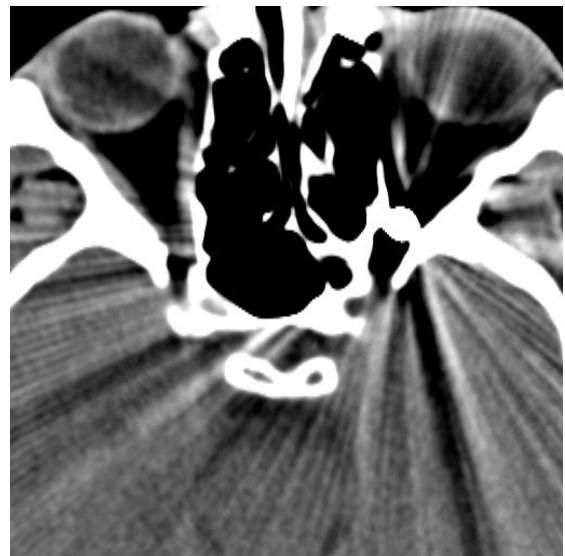
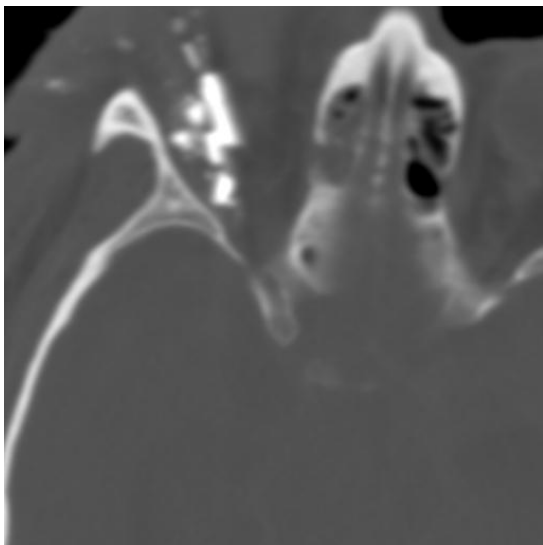
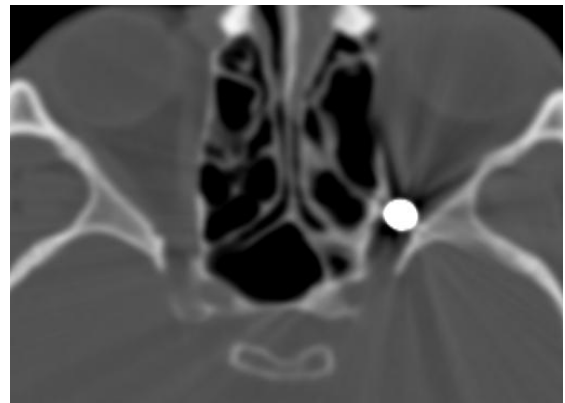
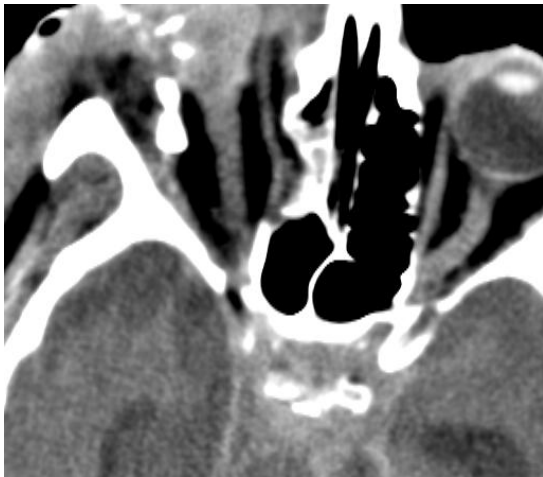
One case revealed an incremental CT image of a carbonite intraocular and intraorbital foreign body. In 5 cases we found out incremental CT images of a metallic intraorbital foreign body. In 3 cases we have spiral CT images of glass intraorbital foreign bodies.

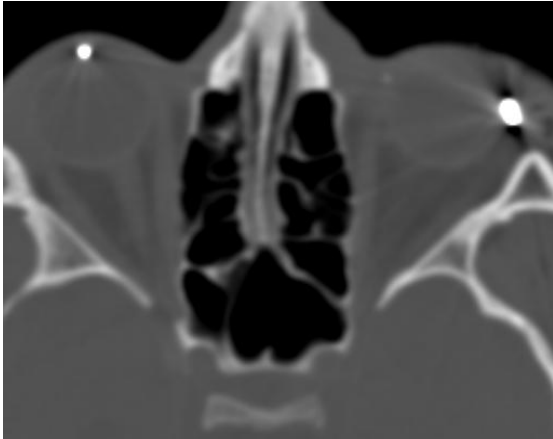
In 2 cases we discovered the spiral CT image of a metallic penetrating intraocular foreign body.

The rest of the cases shows spiral CT image of a metallic penetrating intraocular and maxillofacial foreign body.

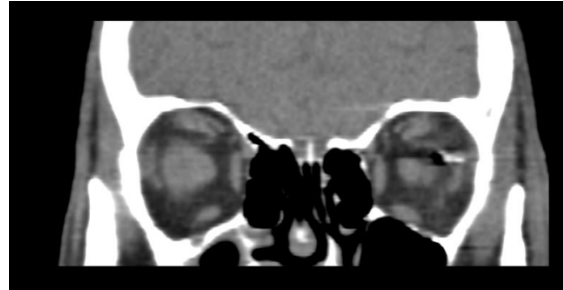
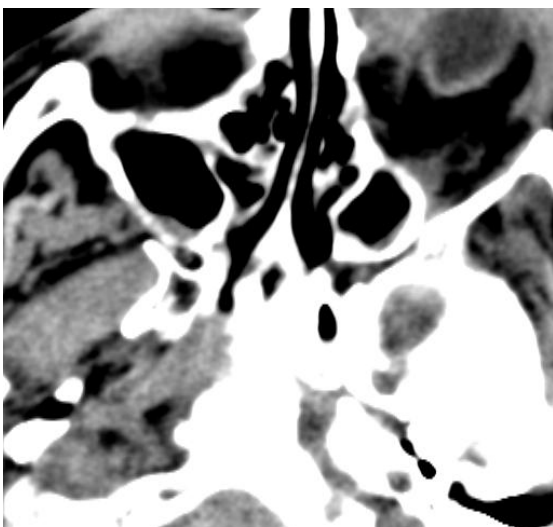
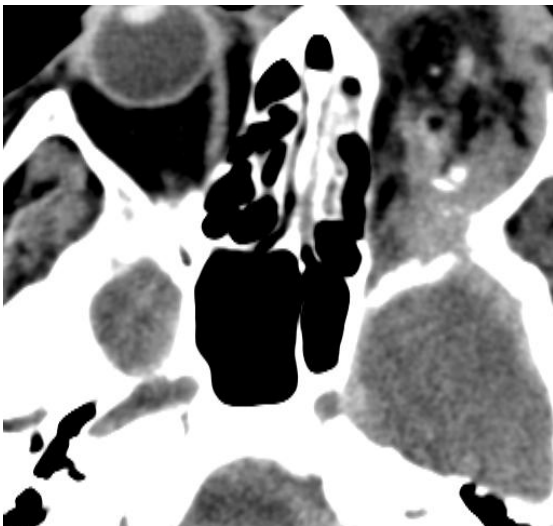


Figures 1, 2, 3 Incremental CT image of a carbonite intraorbital and intraocular foreign

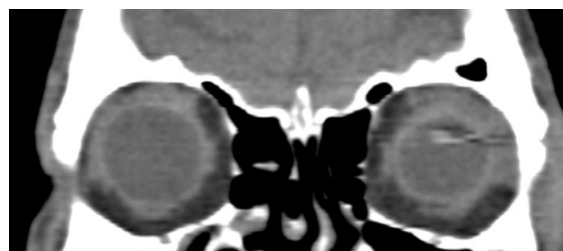
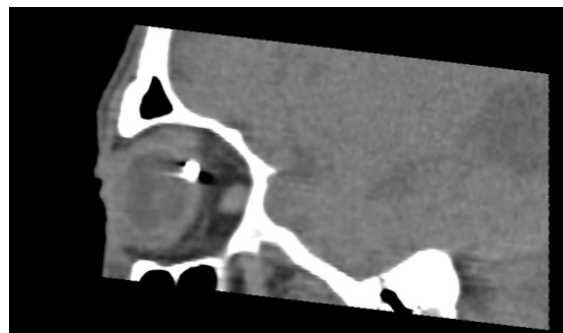




Figures 4, 5, 6 Incremental CT image of an intraorbital foreign body



Figures 7, 8, 9 Images of CT spiral Philips Aura glass intraorbital foreign body



Figures 10, 11, 12 Spiral CT images of penetrant metallic intraocular foreign bodies

Discussion

Computer tomography (CT) is an imaging technique that generates sectional images in the axial plan by scanning a beam of X-rays around the body to be examined.

CT is based on the determination of attenuation coefficients (linear absorption) in tissue – density – of an x-ray beam that passes through the body, the CT image is a "map" of the distribution of tissue densities in the volume of of the section examined (4, 5, 6).

A collimate beam (narrow) X-ray beam passes through the patient body and the intensity is measured by an emergent crown of detectors, disposed diametrically opposite to the X-ray tube; for a given position of the radiogenic tube the measured value of the intensity of the emergent beam is called projection.

Imagine the object beam is reconstructed by computer through the mathematical analysis of its multiple projections (8).

An orbital foreign body may lead to variety of signs, symptoms and clinical findings according to its size, location, velocity and composition. The patients in

this study suffered mostly traumatic injuries. Even if the study involved a small number of patients, the results are similar with other studies on this theme, like the study of Nasr AM, Haik BG, Fleming JC, or study of Leal FAM, Silva e Filho AP.

The patients in this study are 12 aged between 25 - 45 years old, 3 aged between 15 -25 years old, 4 persons aged between 35 - 45 years old and 1 person in the interval between 45 -52 years old.

We can conclude that the incidence of intraorbital and intraocular foreign bodies from traumatic injuries (which represents 63,16% from our cases) is increased at persons aged nearly thirteen.

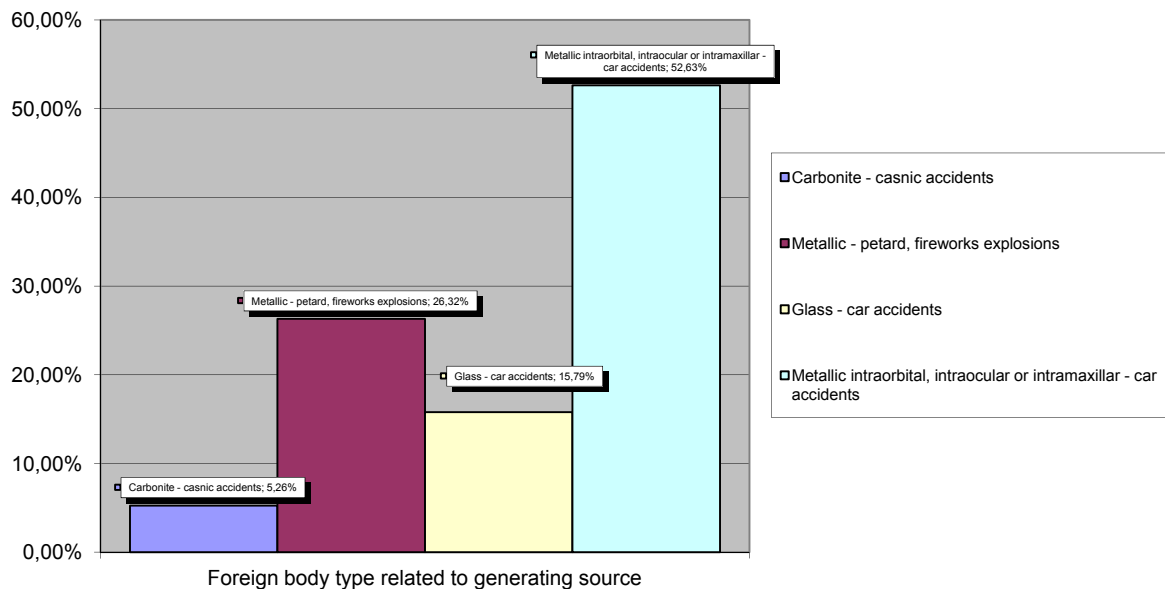
We observe that in five cases we have patients with metallic intraorbital bodies which are the result of small fireworks, petards which exploded in their faces.

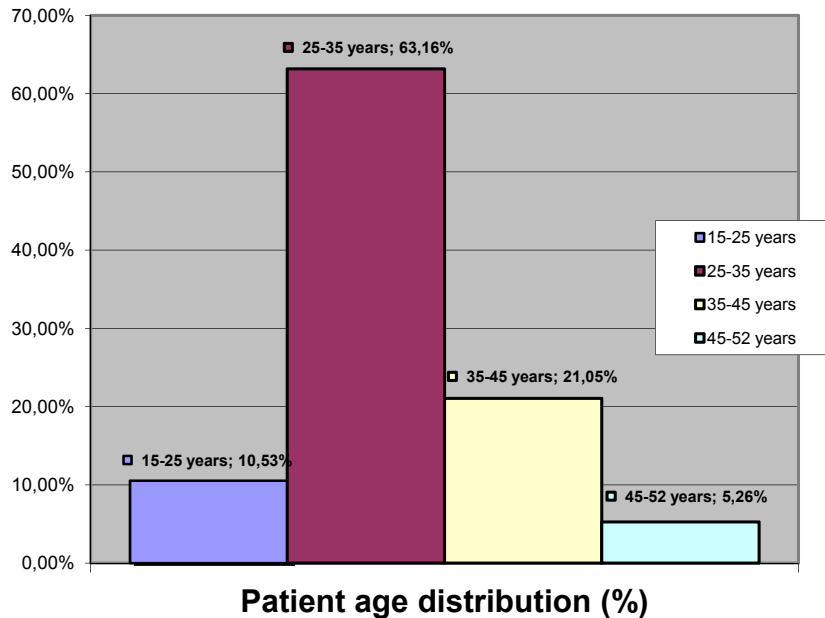
In three cases the IOFB are made by glass as result of an traffic accidents.

One case the IOFB is carbonite in ancasnic accidents.

The rest of our cases are also from traffic accidents and the IOFB are metallic.

We can see that 52,63% from IOFB at our patients are from car accidents.





Intraorbital FBs can be associated with severe injuries leading to loss of vision or may lead to sight-threatening complications (8).

A retained metallic intraorbital FB may cause a variety of signs, symptoms, and clinical findings, based on its size, location, and composition. Loss of vision is usually due to the initial trauma and is generally not influenced by surgical intervention.

The best management of retained metallic intraorbital FBs remains a controversial subject.

The decision regarding surgical removal depends mainly on the location and type of intraorbital

FB (7). However, the removal of foreign body from the orbit, which is crowded with delicate structures, is not safe. Retained metallic IOFBs are well tolerated and should be managed conservatively in the absence of specific indications for removal (12). When the foreign body is

impinging on neurological structures or causing mechanical restriction to ocular

movements, one should consider removal of the FB after detailed and precise localization to minimize damage to the adjacent ocular structures (13).

Conclusion

The classical computer tomography and spiral CT are among the most effective methods of examination and management of intraocular foreign bodies, maxillofacial or intraorbital.

The spiral CT realise a continuous scanning of a volume of the patients body during table movement (9, 10).

The main advantages are related to the fact that there is no section "lost" due to uneven breathing of the patient from one section to another, it can be achieved quality reconstruction in different planes of space and last but not least we have reduced examination time and radiation dose to the patient that is exposed.

CTexam is very important to establish the exact location of the foreign body, to see if the is also an asociated fracture of the

bones of orbit or other bones of the face, and for decide the specific surgical intervention.

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