Involvement pattern of the cranial vault lesions - an iconographic essay

Poster No.: C-1168
Congress: ECR 2017
Type: Educational Exhibit
Authors: A. P. A. Fonseca¹, M. ROSA JUNIOR¹, C. V. BARROSO DE LIMA², M. REUTER CARRERA TORRES², R. DA SILVA ARAUJO², L. ABREU ZORZANELLI², V. A. Soares³; ¹Vitória, Espírito Santo/BR, ²Vitória/BR, ³Vitória ES/BR
Keywords: Neuroradiology brain, Bones, Head and neck, CT, MR, Contrast agent-intravenous, Biopsy, Neoplasia, Infection, Genetic defects
DOI: 10.1594/ecr2017/C-1168

Any information contained in this pdf file is automatically generated from digital material submitted to EPOS by third parties in the form of scientific presentations. References to any names, marks, products, or services of third parties or hypertext links to third-party sites or information are provided solely as a convenience to you and do not in any way constitute or imply ECR's endorsement, sponsorship or recommendation of the third party, information, product or service. ECR is not responsible for the content of these pages and does not make any representations regarding the content or accuracy of material in this file.

As per copyright regulations, any unauthorised use of the material or parts thereof as well as commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method is strictly prohibited.

You agree to defend, indemnify, and hold ECR harmless from and against any and all claims, damages, costs, and expenses, including attorneys' fees, arising from or related to your use of these pages.

Please note: Links to movies, ppt slideshows and any other multimedia files are not available in the pdf version of presentations.

www.myESR.org
Learning objectives

1. Discuss the broad spectrum of clinical, radiological and epidemiological manifestations of the main diseases which affect the skullcap, as well as to expose its various features on Computed Tomography (CT) and Magnetic Resonance Imaging (MRI).

2. The diseases that will be addressed and reviewed are: Camurati Engelmann, Fibrous Dysplasia, Hemangioma, Meningioma, Lymphoma, Metastasis, Multiple Myeloma, Renal Osteodystrophy, Osteosarcoma, Ewing's Sarcoma, Paracoccidiodomcosis, Syphilis and Van Buchem Disease.
Background

Several diseases can manifest themselves with a skullcap injury and, in this context, the radiologist has a long list of differential diagnoses, including congenital, traumatic, neoplastic and inflammatory lesions.

CT provides accurate information about the bones of the skull, being the method of choice for the assessment of bone injuries. The MRI, in turn, provides better delineation of soft tissue involvement, and is able to show the injuries inside the bones at an earlier stage, when they are still restricted to the bone marrow.

Thus, CT and MRI are complementary methods to determine the nature of injuries in skullcap. The diagnosis of the lesions, the patient's age, history of trauma or a primary disease, lytic or sclerotic nature, the involvement of internal or external board, by contrast enhancement pattern, the presence of destruction or expansion, and the lesion being solitary or multiple, shall be taken into account. The radiological approach is essential in the management of the injury, including biopsy, surgery and/or monitoring, for example.

This iconographic essay has as principal objective to illustrate the main lesions of skullcap with their respective clinical, epidemiological and radiographic concepts through a literature review and exposition of case reports.

For educational purposes, we have chosen to split the lesions of the skullcap in:

- Diseases that manifest themselves with predominantly lytic lesions: multiple myeloma, renal osteodystrophy, paracoccidiodomicosis, hemangioma, syphilis.

- Diseases that manifest themselves predominantly with sclerotic lesions: Camurati-Engelmann disease, Van Buchen disease, meningioma on plaques.

- Diseases that manifest themselves with lytic and sclerotic lesions: Ewing's sarcoma, osteosarcoma, fibrous dysplasia, metastases, lymphoma.
Findings and procedure details

A - Predominantly lytic lesions

1 - Multiple Myeloma

It is a malignant neoplasm of plasma cells characterized by plasmacytosis medullary, monoclonal gammopathy, and bone destruction, which might result in fractures, anemia, hypercalcemia and acute renal failure. Diagnosis of the disease occurs, on average, in people in their middle 60s.

The typical clinical picture is characterized by bone pain and fatigue, but may also occur neurologic manifestations leading to swelling, headache and increased intracranial pressure.

Image findings: lytic lesions, osteoporosis or fractures are found affecting mostly vertebrae, skull, ribcage, pelvis and proximal extremities. Furthermore, clearly evidence of well-defined destructive masses on the skull, orbit or the base of the skull, which may involve the neural foramen.

On X-rays, inflatable lytic lesions can be seen (punched out). On CT, the finding is a hyper dense extra-axial mass to the brain tissue, and should be distinguished from meningioma or subdural hematoma. On the MRI, the mass has iso/ hyper signal T1 and iso/hypo signal T2 with light enhancement by contrast.
Fig. 1: Multiple Myeloma. Multiple lytic lesions involving diffusely the skullcap, in the axial plane of the CT (A), MRI T2 (B) sequence and FLAIR (C). (D): it is observed that the lesions also involve the clivus.

References: Radiology, Universidade Federal do Espírito Santo, Hospital Universitário Cassiano Antônio de Moraes - Vitória ES/BR

2 - Renal osteodystrophy

In the renal osteodystrophy, there is a disorder of the metabolism of calcium and phosphate due to chronic renal failure, leading to hypocalcemia and hyperphosphatemia, culminating with increased bone resorption. Clinical manifestations include secondary hyperparathyroidism, osteomalacia, rickets, osteoporosis, adynamic bone disease, as well as soft tissue calcification.

Image findings: the earliest changes include facets of intracortical and endosteal resorption. In the skull, occurs trabecular bone resorption in "salt and pepper". In the mandible, the appearance is of ground glass. After prolonged hyperparathyroidism, there's a picture of well-defined expansive lytic lesions featuring "osteitis cystic fibrosis".

Fig. 2: Renal osteodystrophy. TC in the window bone showing jaw bone with appearance in "salt and pepper" in the coronal view (A) and axial (B). (C): trabecular bone resorption with aspect of "salt and pepper" involving also the diploe of the skullcap. (D) Three dimensional reformatting demonstrating the appearance of cherubism.

References: Radiology, Universidade Federal do Espírito Santo, Hospital Universitário Cassiano Antônio de Moraes - Vitória ES/BR

3 - Paracoccidiomycosis
It is a systemic infection caused by the fungus Paracoccidiodes brasiliensis. It is an endemic disease in the area stretching from Mexico to Argentina, mainly in adults above 30 years old. Involves any part of the body. The lesions in oral mucosa correspond to 80% of involvement in head and neck. Pulmonary involvement is similar to the granulomas of tuberculosis. Less frequently, there are lesions of lymph nodes and adrenal glands. Bone lesions and nervous system are less common.

Image findings: the lesions of skullcap manifest themselves by multiple lytic lesions in the studies of the image. There can be found in Paracoccidioides in the CNS, being more typical in infratentorial location. The MRI can show diffuse leptomeningeal enhancement, with or without signs of hydrocephalus. There is also the shape of pseudotumoral, characterized by rounded hypointense lesions in T1 and T2/FLAIR, with thickened walls and something irregular, showing intense by contrast enhancement.

![Fig. 3: Paracoccidioidomycosis](image)

(A) CT of skull showing two lytic bone lesions, irregular, affecting the entire thickness of the shell: external board, diploe and internal board. One can also notice the increase of adjacent soft tissues. (B) CT, bone window, showing the pattern of involvement of the skullcap, on the right parietal region. (C) Chest CT, post-contrast, demonstrating lymphonodomegaly in right pulmonary hilum. (D) Abdominal CT, post-contrast, demonstrates hypodense mass on right adrenal.

**References:** Radiology, Universidade Federal do Espírito Santo, Hospital Universitário Cassiano Antônio de Moraes - Vitória ES/BR

4 - Hemangioma

Bone hemangiomas are benign vascular lesions with capillaries, veins and cavernous vascular channels. They are more common in middle-aged women, with a peak incidence between the fourth and sixth decade. They are most commonly found in dorsal and lumbar vertebrae bodies, bones of the face and skull cap, mainly in the frontal and parietal bones, and 15% are multiple lesions. They tend to grow slowly and rarely are associated with bleeding.
Image findings: are shown on TC as lytic lesion with trabecular array (honeycomb), and may introduce periosteal reaction in form of rays of the sun and sclerotic margins. The MRI is the best method to show the extent of the damage and its relation to the adjacent neurovascular structures, being typically T1 and T2 hyperintensity and contrast enhancement.

**Fig. 4:** Hemangioma. (A) T1-weighted MRI, axial, with evidence of hyperintense and heterogeneous expansive lesion. (B, C) T2-weighted MRI and FLAIR showing expansive hyperintense lesion. (D) MRI of the skull, axial, T1 post contrast, with expansive lesion with contrast enhancement. (E, F) Expansive lesion with trabecular thickening (honeycomb).

**References:** Radiology, Universidade Federal do Espírito Santo, Hospital Universitário Cassiano Antônio de Moraes - Vitória ES/BR

**5 - Syphilis**

Is a chronic systemic infectious disease caused by Treponema pallidum. Bone and joint involvement is rare in primary and secondary syphilis, being more frequent in late syphilis. The periostitis is the most common injury, with most involved parts: the bones of the skull, tibia, shoulder girdle, spine and femur.
Among the bones of the skullcap, the most affected bones are: frontal and parietal, in descending order. The main symptom is pain that worsens at night. Another symptom that corroborates this diagnosis is hardening swelling on palpation.

Findings: X-rays usually show osteolytic lesions associated with demineralization or sclerosis of the external table and diploe. The internal table is less frequently involved. The CT demonstrates irregular external table destructive process associated with the characteristic of worm-eaten appearance ("eaten by worms"). The MRI has a more complete evaluation than that of the TC, and may show adjacent calvarry edema to destructive lesions and post contrast enhancement of the soft tissue on the scalp. The pattern of subcutaneous lesions, edema in the adjacent bone medullary, and dural thickening is very characteristic of syphilis in calvaria.

![Fig. 5: Syphilis](image)

**Fig. 5:** Syphilis. (A, B) T2-weighted and FLAIR, axial plane, shows increased signal of soft parts in the right temporal region. There is also dural thickening. There is a faint change in the diploe signal in this topography. (C) T1 post-contrast with ring impregnation of soft tissue injury, tenuous impregnation of diploe, in addition to the dural enhancement.

**References:** Radiology, Universidade Federal do Espírito Santo, Hospital Universitário Cassiano Antônio de Moraes - Vitória ES/BR

**B - Predominantly sclerotic lesions**

**1 - Camurati-Engelmann disease**

Also known as progressive diaphyseal dysplasia, it is an autosomal dominant disease in which there is increased osteoblastic activity with decreased osteoclastic activity, leading to symmetric diaphysial sclerosis of the long bones and potential cranial hyperostosis.
The clinical picture of the disease consists of weakness, muscle pain and cranial instability. Approximately 50% of the patients with cranial hyperostosis are asymptomatic, but may include hearing loss, headache, ophthalmopathy and facial paralysis.

Image findings: there is symmetric cortical bone thickening with narrowing of the medullary cavity and loss of diploe differentiation. It is important to note that the hyperostosis is three times more common in anterior and middle fossa. In 25% of cases there are jaw involvement, which helps in differentiation of Van Buchen disease. The changes at the base of skull occur in less than 25% of cases, potentially leading to stenosis of foramina with increased intracranial pressure, decrease in volume of skullcap and neurovascular compromising.

**Fig. 6:** Camurati-Engelmann disease. (A) Diffuse thickening of the diploe. Note the narrowing of the superior orbital fissure and the internal auditory. (B): impairment of the jaw, demonstrated in axial and coronal planes. (C): symmetric thickening of the sphenoid in the coronal plane.

**References:** Radiology, Universidade Federal do Espírito Santo, Hospital Universitário Cassiano Antônio de Moraes - Vitória ES/BR

2 - Van Buchen disease

It is a rare sclerotic bone dysplasia autosomal recessive disorder in which there is excessive bone growth of the skullcap, base of the skull, jaw, ribs and diaphyses of long bones. The clinical picture consists of facial distortions, multiple cranial nerve deficits and recurring headache, dizziness may occur because of increased intracranial pressure. An important feature is that intelligence is not affected.

Image findings: there is a symmetrical increase of the thickness of the skullcap, base bones and jaw. On both CT and MRI there are narrowing of the external and
internal auditory canals, herniation of the cerebellar tonsils, subtotal effacement of the subarachnoid space, in addition to bloating of the subarachnoid space along the optic nerve sheaths.

Fig. 7: Van Buchen disease. MRI demonstrating increased thickness of diploe involving diffusely the skullcap, respectively in the sequences T1 (A) and T2 (B). (C) Sagittal T1 demonstrating the involvement of the jaw, which is common in this disease, and exceptional in Camurati-Engelmann disease. (D) T1-weighted MRI, sagittal plane, showing reduction of the foramen magnum and the cerebellar tonsils ectopia (Chiari I).

**References:** Radiology, Universidade Federal do Espírito Santo, Hospital Universitário Cassiano Antônio de Moraes - Vitória ES/BR

### 3 - Meningioma

They are extra-axial slow-growing tumors mostly benign, composed by neoplastic meningothelial cells. They are equivalent to 34% of intracranial neoplasms and have higher incidence in middle-aged women. They can be macroscopically classified in "globular" or "en plaque".

The symptoms can arise from the irritation of the underlying cerebral cortex, from the hyperostosis or compression of surrounding structures. It manifests more commonly as seizures, increased intracranial pressure, with the involvement of cranial nerves or with focal symptoms.

Image findings: On the CT, in about 60% of cases are hyperdense lesions, and there may be associated calcification. It is often found hyperostosis adjacent to the lesion. On MRI, can be isointense (50%), hyperintense (40%) or hypointense (10%) in relation to the grey matter. Both the CT and MRI feature intense homogenous enhancement by contrast.
**Fig. 8:** Meningioma. (A) CT with thickening/hyperostosis of the left wing of the sphenoid. (B) Thickening/hyperostosis of left temporal and parietal bones. (C) MRI post contrast, evidence "en plaque" extra axial lesion, adjacent to the left wing of the sphenoid. (D) MRI post contrast evidence "en plaque" extra axial lesion, adjacent to hyperostosis.

**References:** Radiology, Universidade Federal do Espírito Santo, Hospital Universitário Cassiano Antônio de Moraes - Vitória ES/BR

**C - Lytic and sclerotic lesions**

**1 - Ewing's Sarcoma**

Ewing's Sarcoma is an undifferentiated neoplasm derived from primitive neuroectodermic cells. Up to 6% affect primarily the skullcap. The peak incidence is between 10 to 15 years old and predominates in men. Clinically, manifests itself most commonly with headache and local edema, being the papilema the most common signal. The preferred place in the skullcap is the frontal bone, followed by the parietal and occipital.

Image findings: the radiography and TC show erosion and concomitant new bone formation, being the frequent periosteal reaction leading to bone arrangement in layers ("in onion peel"). The MRI usually shows hypo/isointense mass on T1, and iso/hyperintense in T2, with heterogeneous contrast enhancement.
Fig. 9: Ewing's Sarcoma. (A) T1-weighted MRI showing expansive lesions centered in the wing of the left sphenoid, with intracranial components been some extra-axial and soft parts of the zygomatic region, in T2 sequences (B), FLAIR (C) and T1 post contrast (D).

References: Radiology, Universidade Federal do Espírito Santo, Hospital Universitário Cassiano Antônio de Moraes - Vitória ES/BR

2 - Osteosarcoma

Osteosarcoma is a primary malignant neoplasm of the bone. It has bimodal incidence affecting adolescents and adults after sixty-five years-old. In 50% of the cases is associated with Paget's disease, fibrous dysplasia, or prior irradiation therapy. Clinically it is characterized as a mass of slow growing, painless or mildly painful, being headache, cranial nerve palsy and exophthalmos its most common symptoms.

Image findings: vary with the relative amount of osteolitic and osteoblastic activity. The lesions may be radiolucent, with little or no visible neoplastic bone; there may be sclerotic training; or be associated with a soft tissue mass. The MRI usually shows irregular bone formation with periosteal new bone formation of type "hair on end" and "Codman's triangle".
Fig. 10: Osteosarcoma. CT with bone window (A) and of soft tissues (B) showing expansive lesion in the right sphenoid, with intracranial and extracranial components and in the zygomatic region on T1 (C), T2 (D), FLAIR (E) and T1 post contrast (F). Watch out for new bone formation and periosteal reaction in figure B.

References: Radiology, Universidade Federal do Espírito Santo, Hospital Universitário Cassiano Antônio de Moraes - Vitória ES/BR

3 - Metastasis

Metastasis is defined as the implantation of a tumor focus at a distance from the original tumor, arising from the spread of the cancer to other organs. It is an important differential diagnosis of lesions of skullcap. The skeleton is the organ most commonly affected by metastatic cancer. The primary tumors that more metastasize to the skull: breast, lung, prostate and kidney. The estimated prevalence of metastasis to the skullcap is 9.7%. They are usually asymptomatic.

Image findings: metastatic lesions can be blastic or lytic. The main neoplasms with blastic metastasis are: lung, breast and prostate. The main neoplasms with litic metastasis
include: thyroid and kidney. In general, they manifest themselves on a MRI hypointense lesions, contrasting with the hyperintensity of the skullcap.

**Fig. 11**: Metastasis. Skull CT demonstrating lytic bone lesion, affecting the entire thickness of the skull: external and internal plate, with soft tissue component intracranial extra-axial (B). (C, D, E and F)-the same pattern demonstrated on MRI.

**References**: Radiology, Universidade Federal do Espírito Santo, Hospital Universitário Cassiano Antônio de Moraes - Vitória ES/BR

4 - Fibrous Dysplasia

Fibrous Dysplasia is an anomaly development that can affect any bone in the body, being caused by a mutation in GNSA1. It is characterized by replacement of normal bone marrow by fibro proliferative bone tissue. It can be presented in three forms: monostotic (including craniofacial), polyostotic and, polyostotic with endocrinopatia. It can affect several age groups, but it is usually more severe in young patients. Most patients tend to be asymptomatic, but the disease can present itself with local pain and swelling, as well as repeated pathological fractures or bone deformities.
Image findings: better evaluated by CT, because on MRI, can present itself in indistinguishable forms of tumors, making diagnosis difficult. Three patterns are described on CT. The most common is the type "Pagetoid" ("ground glass"), in which the mixture of dense and radiolucent areas of fibrosis are observed. Then, in order of frequency, there is the "Sclerotic" type, with evenly dense lesions. And the "Cystic Variety", the most infrequent, with spherical or ovoids lucent lesions, surrounded by a dense layer.

**Fig. 12**: Fibrous Dysplasia. (A) CT showing expansive lesion in ground glass at the base of the skull and the sphenoid bone, plus expansive lesion with cystic pattern on the left branch of lower jaw. (B) CT: expansive lesion in the left branch of lower jaw cystic. (C) CT: expansive lesion in ground glass in ethmoid and sphenoid bone.

**References**: Radiology, Universidade Federal do Espírito Santo, Hospital Universitário Cassiano Antônio de Moraes - Vitória ES/BR

**5 - Lymphoma**

It is a group of derived malignancies of the lymphatic system. There is a peak of incidence in young adults (around 20 years of age), who represent the majority of cases, and another peak in the elderly (approximately 65 years-old).

The lymphoma with involvement of the skullcap is a rare presentation. It is presented with focal deformities in the vault of the skull, particularly the parietal bone, along with edema of the scalp. Some signs may provide the brain parenchyma by tumor invasion, namely: seizures, focal deficits, apraxia, mental confusion.

Image findings: the most commonly affected are the scalp, skull bones and meningeal compartments. They are shown on CT as hyperdense lesions, which may vary from sclerotic to lytic. In general, are focal lesions, and there is no bone erosion. On MRI,
one may notice iso/hyposignal T1 and iso/hypersignal T2, with homogeneous contrast enhancement.

**Fig. 13:** Lymphoma. (A, B and C) CT demonstrates absence of bone erosion despite the intense involvement of soft parts in right parietal region and intracranial extra-axial hyperdense lesion. (D) T2-weighted MRI, demonstrating lesions on the soft tissue and extra-axial intracranial hyperintense on the right parietal region. (E, F) MRI T1 post contrast with impregnation of soft tissues and of the extra-region intracranial lesion on the right parietal region.

**References:** Radiology, Universidade Federal do Espírito Santo, Hospital Universitário Cassiano Antônio de Moraes - Vitória ES/BR
Fig. 1: Multiple Myeloma. Multiple lytic lesions involving diffusely the skullcap, in the axial plane of the CT (A), MRI T2 (B) sequence and FLAIR (C). (D): it is observed that the lesions also involve the clivus.

© Radiology, Universidade Federal do Espírito Santo, Hospital Universitário Cassiano Antônio de Moraes - Vitória ES/BR

Fig. 2: Renal osteodystrophy. TC in the window bone showing jaw bone with appearance in "salt and pepper" in the coronal view (A) and axial (B). (C): trabecular bone resorption with aspect of "salt and pepper" involving also the diploe of the skullcap. (D) Three dimensional reformatting demonstrating the appearance of cherubism.

© Radiology, Universidade Federal do Espírito Santo, Hospital Universitário Cassiano Antônio de Moraes - Vitória ES/BR
Fig. 3: Paracoccidioidomycosis. (A) CT of skull showing two lytic bone lesions, irregular, affecting the entire thickness of the shell: external board, diploe and internal board. One can also notice the increase of adjacent soft tissues. (B) CT, bone window, showing the pattern of involvement of the skullcap, on the right parietal region. (C) Chest CT, post-contrast, demonstrating lymphonodomegaly in right pulmonary hilum. (D) Abdominal CT, post-contrast, demonstrates hypodense mass on right adrenal.

© Radiology, Universidade Federal do Espírito Santo, Hospital Universitário Cassiano Antônio de Moraes - Vitória ES/BR

Fig. 4: Hemangioma. (A) T1-weighted MRI, axial, with evidence of hyperintense and heterogeneous expansive lesion. (B, C) T2-weighted MRI and FLAIR showing expansive hyperintense lesion. (D) MRI of the skull, axial, T1 post contrast, with expansive...
lesion with contrast enhancement. (E, F) Expansive lesion with trabecular thickening (honeycomb).

© Radiology, Universidade Federal do Espírito Santo, Hospital Universitário Cassiano Antônio de Moraes - Vitória ES/BR

**Fig. 5:** Syphilis. (A, B) T2-weighted and FLAIR, axial plane, shows increased signal of soft parts in the right temporal region. There is also dural thickening. There is a faint change in the diploe signal in this topography. (C) T1 post-contrast with ring impregnation of soft tissue injury, tenuous impregnation of diploe, in addition to the dural enhancement.

© Radiology, Universidade Federal do Espírito Santo, Hospital Universitário Cassiano Antônio de Moraes - Vitória ES/BR

**Fig. 6:** Camurati-Engelmann disease. (A) Diffuse thickening of the diploe. Note the narrowing of the superior orbital fissure and the internal auditory. (B): impairment of the jaw, demonstrated in axial and coronal planes. (C): symmetric thickening of the sphenoid in the coronal plane.

© Radiology, Universidade Federal do Espírito Santo, Hospital Universitário Cassiano Antônio de Moraes - Vitória ES/BR
**Fig. 7:** Van Buchen disease. MRI demonstrating increased thickness of diploe involving diffusely the skullcap, respectively in the sequences T1 (A) and T2 (B). (C) Sagittal T1 demonstrating the involvement of the jaw, which is common in this disease, and exceptional in Camurati-Engelmann disease. (D) T1-weighted MRI, sagittal plane, showing reduction of the foramen magnum and the cerebellar tonsils ectopia (Chiari I).

© Radiology, Universidade Federal do Espírito Santo, Hospital Universitário Cassiano Antônio de Moraes - Vitória ES/BR

**Fig. 8:** Meningioma. (A) CT with thickening/hyperostosis of the left wing of the sphenoid. (B) Thickening/hyperostosis of left temporal and parietal bones. (C) MRI post contrast, evidence "en plaque" extra axial lesion, adjacent to the left wing of the sphenoid. (D) MRI post contrast evidence "en plaque" extra axial lesion, adjacent to hyperostosis.

© Radiology, Universidade Federal do Espírito Santo, Hospital Universitário Cassiano Antônio de Moraes - Vitória ES/BR
Fig. 9: Ewing’s Sarcoma. (A) T1-weighted MRI showing expansive lesions centered in the wing of the left sphenoid, with intracranial components been some extra-axial and soft parts of the zygomatic region, in T2 sequences (B), FLAIR (C) and T1 post contrast (D).

© Radiology, Universidade Federal do Espírito Santo, Hospital Universitário Cassiano Antônio de Moraes - Vitória ES/BR
**Fig. 10:** Osteosarcoma. CT with bone window (A) and of soft tissues (B) showing expansive lesion in the right sphenoid, with intracranial and extracranial components and in the zygomatic region on T1 (C), T2 (D), FLAIR (E) and T1 post contrast (F). Watch out for new bone formation and periosteal reaction in figure B.

© Radiology, Universidade Federal do Espírito Santo, Hospital Universitário Cassiano Antônio de Moraes - Vitória ES/BR

![Fig. 10](image)

**Fig. 11:** Metastasis. Skull CT demonstrating lytic bone lesion, affecting the entire thickness of the skull: external and internal plate, with soft tissue component intracranial extra-axial (B). (C, D, E and F)-the same pattern demonstrated on MRI.

© Radiology, Universidade Federal do Espírito Santo, Hospital Universitário Cassiano Antônio de Moraes - Vitória ES/BR
**Fig. 12:** Fibrous Dysplasia. (A) CT showing expansive lesion in ground glass at the base of the skull and the sphenoid bone, plus expansive lesion with cystic pattern on the left branch of lower jaw. (B) CT: expansive lesion in the left branch of lower jaw cystic. (C) CT: expansive lesion in ground glass in ethmoid and sphenoid bone.

© Radiology, Universidade Federal do Espírito Santo, Hospital Universitário Cassiano Antônio de Moraes - Vitória ES/BR
Fig. 13: Lymphoma. (A, B and C) CT demonstrates absence of bone erosion despite the intense involvement of soft parts in right parietal region and intracranial extra-axial hyperdense lesion. (D) T2-weighted MRI, demonstrating lesions on the soft tissue and extra-axial intracranial hyperintense on the right parietal region. (E, F) MRI T1 post contrast with impregnation of soft tissues and of the extra-region intracranial lesion on the right parietal region.

© Radiology, Universidade Federal do Espírito Santo, Hospital Universitário Cassiano Antônio de Moraes - Vitória ES/BR
Conclusion

It is noticed the existence of a wide variety of injuries in skullcap, which require the systematic approach to its correct diagnosis. With this study one can conclude that the true etiology can be intriguing when the medical evaluation is based only on image findings. Therefore, it is necessary to correlate the epidemiological data, with clinical and radiological ones, according to what was exemplified in the course of this iconographic study.
References


