ROENTGEN DIAGNOSIS OF PARANASAL DISEASE USING RETROBULBAR AIR INSUFFLATION

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眠窩内空気注入による副鼻腔疾患のX線診断

眠窩内麻酔注入による眠窩内異物のX線診断は、第二次世界大戦中に試みられた。眠窩内空気注入後X線断層撮影による眠窩内腫瘍診断は、1956年Ber特斯ンによって発展された。著者は、より簡便なる眠窩内空気注入法を用い、眠窩疾患のX線診断のみならず、眠窩周辺の睡眠管状態の診断に応用した。

空気約8.0ccを眼球後部軟部組織卒注入後X線断層撮影により眼球ならびに視神経に注入した空気により反射的に観察され同時に眠窩内異物が追求される。のちに眠窩周辺部睡眠管状態のX線診断にきわめて有効である。とくに、眠窩内腫瘍が眠窩内へ浸入した場合は、X線単純撮影によって不明瞭なる時でも、眠窩内空気注入後X線断層撮影法により比較的正確なる診断が可能である。眠窩内腫瘍の眠窩への浸潤在否は、睡眠断層撮影によって判明するか否かを決定するかが必要である。手術適否を決定するか否かにたいして必要である。睡眠断層撮影法は、睡眠疾患はもちろん、睡眠管状態、睡眠疾患はともに睡眠管状態の診断法として重要である。

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Orbital air of oxygen injection was used during World War II by Drs. Schlich and Hodes for roentgen diagnosis of foreign body localization. Dr. Bertelsen used retrobulbar air insufflation for roentgen diagnosis of orbital tumor. Tomographic examination was performed after retroluerar air insufflation by Dr. Bertelsen. The author used a simplified modification of Dr. Bertelsen's method in orbital disease as well as in paranasal disease.

Method and Technique

Without anesthesia a 5 cm long 20 gauge needle is inserted into the orbit through the lateral portion of the lower or upper eyelid skin, avoiding the eyeball. When the needle meets the inferior posterior or superior posterior orbita wall the needle is
pulled backward about 1 cm, redirected 30° upwards and inserted about 1-2 mm further. A slight resistance is felt as it puncture the fascia of the rectus muscle. 5 tc 8 cc of air are then injected very slowly, filling the retrobulbar soft tissue which is well surround by ocular muscles and it is mostly consisted of fat tissue and optic nerve. The injected air is spreading homogenously retrobulbar space and leaked to the subconjunctival space the air insufflation is counted to be successful. Posterior and anterior tomograms of the orbits including maxillary sinuses are made 0.5 cm to 5 cm with 5 mm between each centimeter cut. Straight lateral tomograms including maxillary sinus are also made 1 cm to 7 cm with 5 mm between each centimeter cut. After the examination aspiration of 2-3 cc of air through subconjunctival puncture is usually possible and the aspiration reduces patient’s discomfort. The remained air is absorbed completely within 48 hours but mostly within 24 hours. Not a single serious complications such as air embolism were met after 150 examinations. During and after air insufflation the patient feels heaviness and discomfort in the eye, but it disappears within 12 hours. This method can be done in out patient base.

Indications:
Tomographic examination after retrobulbar air insufflation is a very important diagnostic method of orbital tumor (Fig. 1) (Fig. 2) and optic nerve pathology (Fig. 3) (Fig. 4) (Fig. 5). The author has used it to show orbital involvement in advanced disease of the paranasal sinuses, information of great therapeutic importance.

Results
The method cutlines with air the orbital and periorbital bony structures, the orbital soft tissue, and in particular the eyeball and optic nerve. Displacement of the eyeball and optic nerve are clearly demonstrated (Fig. 3). By tomographic examination of orbita including nose and paranasal sinuses the bony walls of the paranasal sinuses are nicely visible. When the maxillary cancer (Fig. 6) or ethmoid cancer (Fig. 7) involves the orbit bony destruction and displacement of the eyeball are demonstrated, while in conventional films it is very difficult to judge. In case of orbital involvement of maxillary or ethmoid cancer the eyeball should be enucleated even unimpaired of the vision. By this method the posterior wall destruction of maxillary sinus in maxillary cancer is clearly demonstrated in the lateral tomographic examination, while it is very difficult to determine in conventional film (Fig. 8) (Fig. 9). If the posterior wall is involved by tumor destruction the case could not be operated. In 5-7 cm cut lateral tomographic films the sphenoid sinus and sella turcica are clearly seen and if the tumor is invaced sphenoid sinus (Fig. 10) the case should not be operated.

By using this method, in cases of frontal sinus mucocele (Fig. 11) or osteoma the relationship between orbita and diseased frontal sinus is well demonstrable, and gives good preoperative evaluation.
Summary and Conclusion:
Tomographic examination of orbita after retrophalbar air insufflation is very important diagnostic method in orbital disease, and also this method is very useful preoperativ procedure in advanced peranasal disease specially in maxillary and ethmoid cancer.

The author's simplified method can be used in out patient base without any serious complications.

References
Fig. 1 (a): 16 years old male patient who has 3 years history of the right side esophthalmus and gradual loss of vision. A.P.A. tomogram after 8cc of retrobulbar air insufflation.
 a) Good outlineing of the right eyeball which is a little dislocated laterally and downwards.
b) Oblique muscle.

Fig. 1 (b): Same patient's lateral tomogram of 2 cm cut.
a) Eyeball
b) Optic nerve which is a little pushed upwards.
c) A rounded tumor mass which is attached to the posterior wall of the orbit. By surgery it is proved to be a large neurinoma.

Fig. 2 (a): A PA tomogram after retrobulbar air insufflation in a case retinoblastoma.
 a) Good outlineing of the eyeball with air. No pathology.
Fig. 2 (a): A lateral tomogram of the same patient.
   a) Eyeball                  b) optic nerve
   c) Calcification of the retina.

Fig. 3: Normal size of an optic nerve after retrobulbar air insufflation.
   a) Eyeball                  b) Normal size of an optic nerve

Fig. 4: A lateral tomogram in a case of optic nerve atrophy
   a) Eyeball                  b) Very small atrophic optic nerve
Fig. 5: A lateral tomogram in a case of optic neuritis after retrobulbar air insufflation.
   a) Eyeball  a) Swollen optic nerve which is two times bigger than the normal one.

Fig. 6: A P.A. tomogram in a case of maxillary cancer after retrobulbar air insufflation.
   a) Lateral displacement of the eyeball due to tumor involvement in the orbita.
   b) Extensive tumor in the left maxillary sinus destroying the inferior wall of the orbita
       and involvement of the left ethmoid sinus and left nasal cavity. The tumor is also
       invading the medial part of the orbital cavity.

Fig. 7: A P.A. tomogram in a case of ethmoid cancer after retrobulbar air insufflation.
   a) Lateral displacement of the eyeball due to tumor invasion of the orbita from ethmoid sinus.
   b) Extensive tumor in the left ethmoid sinus extending to the medial orbital cavity, and also
       this tumor is invading the entire left nasal cavity.
   c) No tumor involvement of the left maxillary sinus.
Fig. 8: A lateral tomogram of extensive maxillary cancer after retrobulbar air insufflation.

a) Normal eyeball  
b) Normal optic nerve.  
c) Tumor filling of the maxillary sinus and complete destruction of the inferior wall of the maxillary sinus and a tooth is hanging on the tumor.  
d) Tumor destruction of the superior wall of the maxillary sinus and remaining paper thin wall.  
e) Tumor destruction of the posterior wall of the maxillary sinus, and processus pterygoideus is seen behind the destroyed posterior wall without destruction.

Fig. 9: A lateral tomogram of a maxillary cancer case after retrobulbar air insufflation.

a) Tumor filling of the maxillary sinus.  
b) Tumor destruction of the posterior wall of the maxillary sinus.  
c) Tumor destruction of the posterior most part of the inferior wall of the orbits.
Fig. 10: 7 cm cut lateral tomogram of a case of maxillary cancer after retrobulbar air insufflation.
   a) Extensive tumor involvement of sphenoid sinus.
   b) Sella turcica which is not destroyed by the tumor.

Fig. 11: A lateral tomogram of a case of frontal sinus mucocele after retrobulbar air insufflation.
   a) Large frontal mucocele invading the orbit, after destroying the superior wall of the orbit.
   b) Optic nerve which is a little compressed downwards by the frontal mucocele.