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Traumatic and Postoperative Intracranial Air on Computerized Tomography

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Summary: Intracranial air can be easily diagnosed and its location correctly assessed by computerized tomography. It can be seen in association with fracture, paranasal sinusitis, and following craniotomy or intraventricular drainage. Intracranial air may be epidural, subdural, subarachnoid, parenchymal, or intraventricular.

Key words: Pneumocephalus, computerized tomography.

The introduction of air for diagnostic procedures such as pneumoencephalography or vnetriculography is the most common cause of pneumocephalus (1,2,19). Intracranial air can be easily diagnosed by computerized tomography (CT) and in the absence of prior diagnostic or surgical procedures, the peresence of intracranial air is of serious clinical significance. In this study 29 patients with intracranial air are presented and various pathologies are illustrated.

Clinical Material

We have performed over 3500 CT scans in our unit between the year 1986 and 1988. Twentynine patients (0.77 %) had intracranial air. The patient population consisted of 15 male and 14 female with a mean age of 27 years. We have selected scans from several of these cases to illustrate both the clinical significance and varied appearance of intracranial air on CT scans.

Results

The appearance of intracranial air on CT scans is quite characteristic. Air appears as a region of very low attenuation (-1000 H) with a white rim surrounding the air pocket.

The clinical and CT findings of the patients are summarized in table I.

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Table I: Clinical summary in 29 patients with intracranial air seen on computerized tomography scanning.

Case No	Age	Clinical history	CT findings
1	18 months M	Post meningitis subdural effusion, after draining bilateral burrholes	Bi frontal subdural air
2	6 months M	Post meningitic subudral effusion, after draining bilateral burrholes	Bi frontal subdural air
3	11 months M	Post meningitic subudral effusion, after draining bilateral burrhole	Left frontal subdural air
4	9 months F	Post meningitic subudral effusion, after draining bilateral burrholes	Right frontal subdural air
5	17 months F	Post meningitic subudral effusion, after draining bilateral burrhole	Left frontal subdural air
6	7 months F	Post meningitic subudral effusion, after unilateral evacuation	Right frontal subdural air
7	16 months M	Post meningitic subudral effusion, after unilateral evacuation	Bi frontal subdural air
8	70/M	Chronic subdural hematoma after unilateral evacuation	Left frontal subdural air
9	72/F	Chronic subdural hematoma after draining bilateral burr-holes	Bifrontal subdural air
10	69/M	Chronic subdural hematoma after daining bilateral burr-holes	Right frontal subdural air
11	68/F	Chronic subdural hematoma after daining bilateral burr-holes	Right frontal subdural air
12	21/F	Acute subdural hematoma after unilateral evacuation	Right frontal subdural air
13	37/M	Acute subdural hematoma after unilateral evacuation	Left frontal subdural air
14	9 months F	Post ventircular peritoneal shunt, congenital hydrocephaly	Bilateral intraventricular air
15	4 months M	Post ventricular peritoneal shunt, congenital hydrocephaly	Bilateral intraventicular air
16	2 months M	Post ventricular peritoneal shunt, congenital hydrocephaly	Right intraventircular air
17	5 months F	Post meningitis hydrocephaly post ventricular peritoneal shunt	Right intraventricular air

18	17/F	Aquaduct stenosis, after shunt revision	Right intraventricular air
19	22/M	Basilar skull fracture	Intraventircular, subarachnoid sylvian,cysterns air
20	13/F	Basilar skull fracture	Right subdural air
21	65/F	Right falx meningioma after removal	Right intracaviter air
22	50/F	Tuberculum sella meningioma after removal	Right frontal subdural air
23	2/M	Brain abscess after draining	Intracaviter air
24	21/M	Chronically draining right ear	Temporal parenchymal air
25	38/M	Acute epidural hematoma	Parietal subdural air
26	69/M	Spontan intracerebral hematoma after evacuation	Right subdural air
27	56/F	Spontan intracerebral hematoma after evacuation	Intracaviter air
28	13/M	Posterior fossa tumour after tumour evacuation	Left subdural air
29	62/M	Posterior fossa tumour after evacuation	Right intraventricular air

Discussion

The appearance of intracranial air on CT scans is quite characteristic . It appears as a region of very low attenuation (-1000 H) with a white rim surrougnding the air pocket (Fig la-b). This "halo" effect is a reconstruction artifact caused by the marked, abrupt change in attenuation between the air and surrounding cerebral parenchyma (3), and should not be mistaken for an associated hematoma.

Intraventricular air is easily distinquished since it confroms to the ventricular spaces (Fig 1a, b). Air-CSF levels can usually be idantified. Since most CT scans are performed in the brow-up position, intraventricular air is most commonly present in the frontal and temporal horns.

Subarachnoid air easily identified as small, non confluent bubbles of low attenuation conforming to the sulci and cerebropsinal fluid cisterns (Fig 2a). While subarachnoid air may change position, the air pockets are nonconfluent and can thus usually be easily distinquished from subdural collections. Subdural air commonly forms a well defined gravitational level with subdural fluid collections (Fig 2b). If it is of sufficient size and is unilateral or asymmetrical, subdural "tension pneumocephalus" may develop (8).

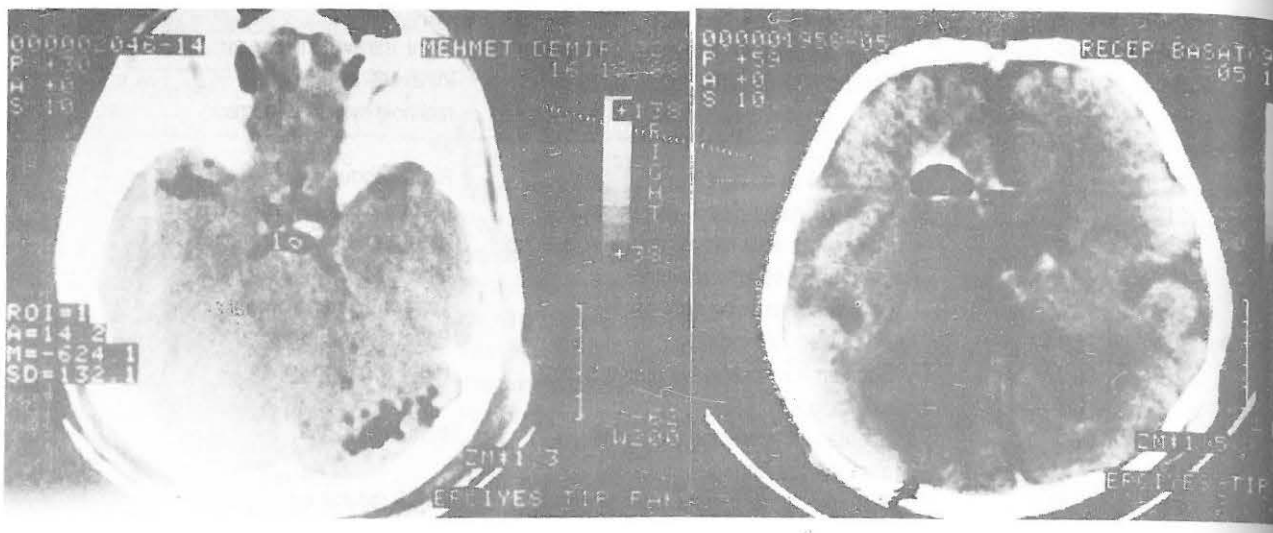


Fig 1. Computerized tomography scans without contrast enhancement. Left: Intraventricular air. Right:Intraventircular air forms a distinct gravitational level with the cerebrospinal fluid.

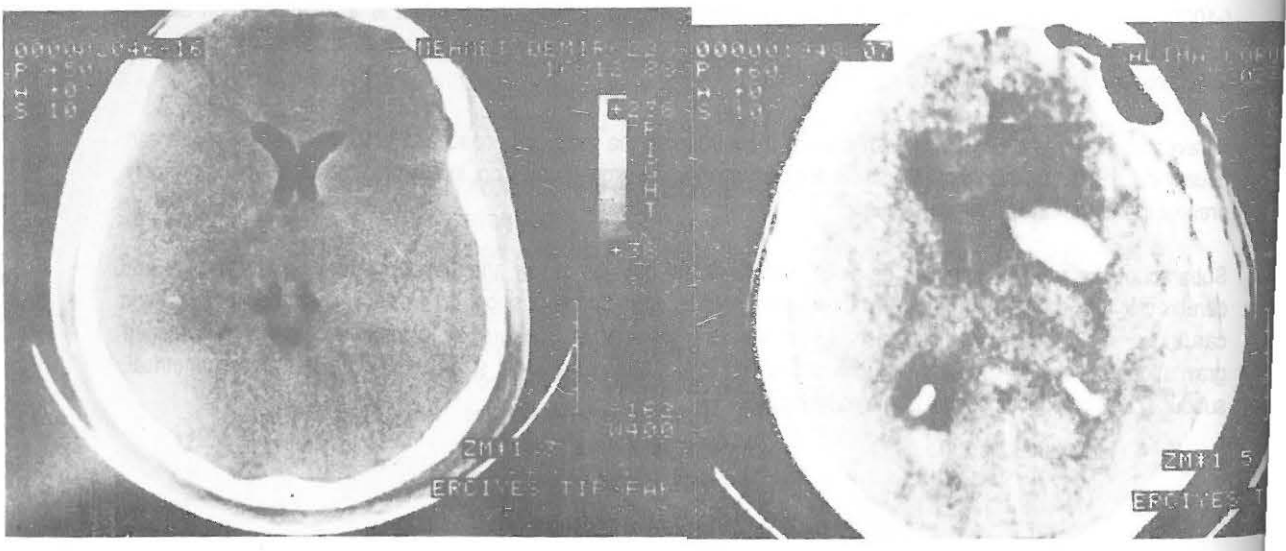
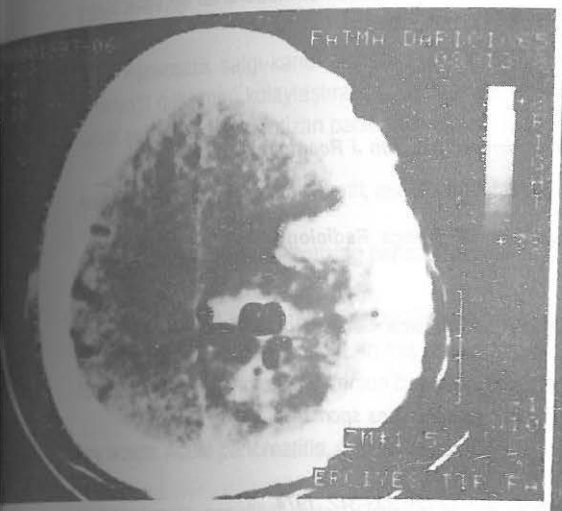
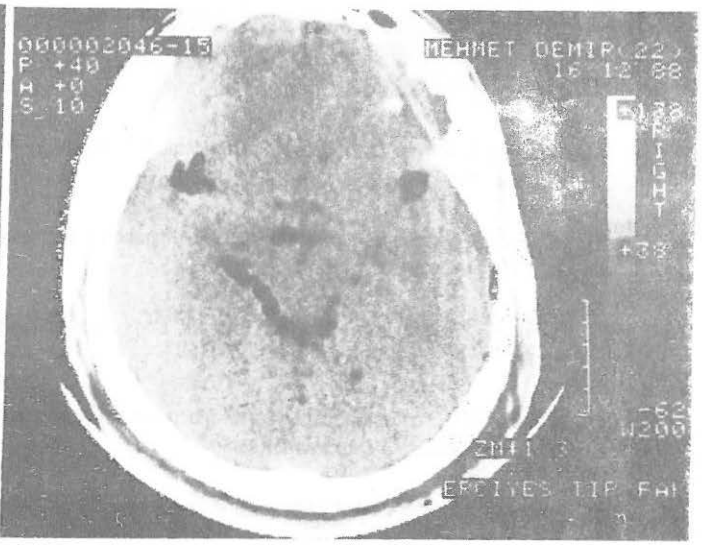


Fig 2. a. Computerized tomography scan after head trauma. Subarachnoid air is seen as non confluent bubbles of low attenuatio b. Right frontal subdural pneumatoma.

Parenchymal air is seen as an area of low attenuation lying within the cerebral substance (Fig 3a,b,c).





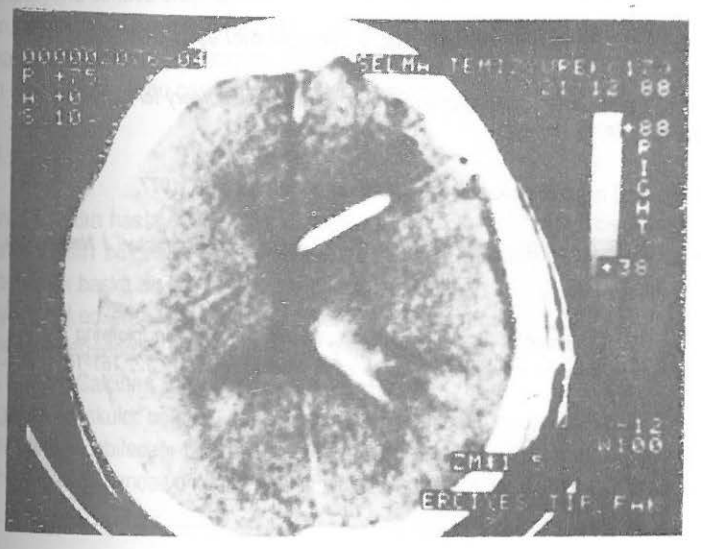


Fig 3. a. Air is seen in the cavity after tumour removel. Note the artifactural white "halo surroundingthe air collections. Parenchymal air is seen as an area of low attenuation lying within the cerebral substance(b-c).

Pneumocephalus most commonly occurs after surgery (8), trauma (3), infection or fracture of the petrous temporal bone (5,7,9) cerebral abscess (1,6), tumours of the sinuses or skull base (4), and fallowing craniotomy or intraventricular drainage (11). Potentially serious complications of intracranial air, such as tension pneumocephalus, can be accurately identified by CT scanning facilitating appropriate therapy. The identification of intracranial air collection in various clinical conditions would alert the clinician for its potentially serious sequelae.

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