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THE VALUE OF BRAIN CT SCAN IN EMERGENCY SERVICE: A RETROSPECTIVE ANALYSIS

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SUMMARY – The objective of the study was evaluation and radiologic – clinical correlation of brain computed tomography (CT) scans performed at emergency service. The relation between the number of urgent and total CT scans performed during a 2-year period (January 1, 2001 – December 31, 2002) was analyzed. Emergency brain CT scans were especially investigated according to clinical indications, requests from particular clinical specialties, and need of anesthesiologist's assistance. CT scans were correlated with clinical examinations and diagnoses as well as with literature data. During the study period, 15,933 CT scans were performed at our department, 3132 (19.66%) of them at emergency service (1757 male and 1375 female, mean age 56.97 years), and 2576 (82.25%) of the latter emergency brain CT scans (1398 male and 1178 female, mean age 57.80 years). Data analysis showed the following distribution of emergency brain CT scans according to hospital departments: neurology 1441 (55.94%), neurosurgery 632 (24.53%), internal medicine 186 (7.22%), surgery 138 (5.36%), other departments 150 (5.82%), and other institutions 29 (1.13%). Clinical diagnoses for emergency brain CT scanning were as follows: stroke 905 (35.13%), subarachnoid hemorrhage 128 (4.97%), head injury 617 (23.95%), consciousness disorders and convulsions 389 (15.10%), intracranial expansive lesions 234 (9.08%), headache and/or vertigo 141 (5.47%), cerebrovascular insufficiency 50 (1.94%), infectious disease 46 (1.79%), hydrocephalus 12 (0.47%), metabolic disorders 2 (0.08%), and lost or unavailable data at the time of the study 52 (2.02%). Anesthesiologist's assistance during emergency brain CT scanning was needed in 234 (9.08%) cases. Correlation of CT findings with clinical diagnosis yielded the following results: 96 (3.73%) lost or unavailable data at the time of the study, 639 (25.77%) normal findings, and 1841 (74.23%) pathologic findings. Study results showed the number of emergency brain CT scans to be quite high with a tendency of continuous growth (cerebrovascular disorders, new therapeutic approaches, head injury). Difficulties encountered on brain CT scanning because of the patient's state, and delicacy of the emergency interpretation of CT scans impose the need of higher availability of a neuroradiologist within the frame of the emergency state algorithm.

Key words: *Brain – radiography; Central nervous system diseases – radiography; Tomography – x-ray – computed – utilization; Emergencies; Emergency service – hospital*

Introduction

Stroke and head injury are the most common reasons for the emergency cranial computed tomography (CT) studies at emergency departments because of their high incidence and mortality rates in modern societies. Despite the proved advantages of magnetic resonance imaging (MRI) in detecting vascular and brain injuries, CT remains the most rapid, most convenient and widely available modality to provide images in acute stroke and head injury patients.

Stroke, either ischemic or hemorrhagic, is a common and serious disease with over a half a million of new cases and 150,000 deaths *per* year in the United States (US)[1].

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CT has been traditionally used in acute stroke to exclude cerebral hemorrhage – intracerebral hemorrhage and subarachnoid hemorrhage (SAH), since these patients may rapidly deteriorate because of increased intracranial pressure, and to identify possible alternative pathologies such as tumors or arteriovenous malformations (AVMs). Development of a new generation of higher resolution spiral CT scanners and new methods in the treatment of acute stroke such as thrombolytic therapy in ischemic stroke (thrombolytic drugs can dissolve clots that reduce perfusion by obstruction of cerebral vessels), and prevention of intracerebral hematoma enlargement have changed the use of CT in acute stroke.

Traumatic injury is the most common cause of death and permanent disability in the early decades of life. The neurologic aspects of trauma are responsible for the vast majority of these deaths and disabilities. A minimum of 500,000 new cases of head injury can be expected to occur in the US each year. Up to 10% of the new cases will be fatal, and 20% to 40% will be at least moderate in severity. As many as 5% to 10% of those victims that survive will experience some degree of residual neurologic deficit[2]. The primary task of the diagnostic radiologist in neurotraumatology is to provide diagnostic information crucial to the clinical management in order to reduce the morbidity and mortality.

With this retrospective study, we want to point to the important part of the pathology we deal with in our daily emergency service routine. The aim was to evaluate emergency CT studies, to analyze emergency brain CT studies, to correlate clinical and radiologic CT findings, and to correlate these findings with literature data.

Patients and Methods

Patients

Between January 1, 2001 and December 31, 2002, 15,933 CT examinations were performed at our department; 3132 (19.66%) of these were emergency CT examinations performed in 1375 (43.90%) female and 1757 (56.10%) male patients, mean age 56.97 years. Out of 3132 emergency CT examinations, 2576 (82.25%) were brain, 291 (9.29%) abdominal, 132 (4.21%) thoracic, 61 (1.95%) spinal CT scans, and 72 (2.30%) CT scans of the orbit, paranasal sinuses, temporal bone, neck or pelvis (Table 1).

Evaluation of medical records and CT findings of patients submitted to emergency CT scan of the head during the study period yielded the following results: a total of 2576 emergency brain CT scans were carried out in 1178 (45.73%) female and 1398 (54.27%) male patients, mean age 57.80 (range 0-93) years. Emergency CT studies of the head were requested for the following clinical diagnoses: stroke (n=905; 35.13%), SAH (n=128; 4.97%), head injury (n=617; 23.95%), consciousness disorder and convulsions (n=389; 15.10%), intracranial expansive lesion (n=234; 9.08%), and other symptoms (n=251; 9.75%), i.e. headache and/or vertigo (n=141; 5.47%), cerebrovascular insufficiency (n=50; 1.94%), infectious disease (n=46; 1.79%), hydrocephalus (n=12; 0.47%), and metabolic disorders (n=2; 0.08%). In 52 (2.02%) patients, data were lost and unavailable at the time of the study. Clinical diagnoses for emergency brain CT scan are summarized in Table 2.

Table 1. Distribution of emergency CT examinations (January 2001 – December 2002)

Emergency CT	n	%
Head CT	2576	82.25
Abdominal CT	291	9.29
Thoracic CT	132	4.21
Spinal CT	61	1.95
– cervical spine	16	
– thoracic spine	9	
– lumbosacral spine	36	
Other emergency CT (orbit, PNS, temporal bones, neck, pelvis)	72	2.30

Table 2. Clinical diagnoses for emergency brain CT examinations

Clinical diagnosis	n	%
Stroke	905	35.13
Subarachnoid hemorrhage	128	4.97
Head injury	617	23.95
Consciousness disorders and convulsions	389	15.10
Intracranial expansive lesions	234	9.08
Headache and/or vertigo	141	5.47
Cerebrovascular insufficiency	50	1.94
Infectious disease	46	1.79
Obstructive hydrocephalus	12	0.47
Metabolic disorder	2	0.08
Lost and unavailable data	52	2.02

Methods

Emergency brain CT studies were performed with two CT scanners: Shimadzu Intellect 4800 (throughout the study) and Siemens Somatom DRH (in use from January to June 2001). Brain CT studies were done with 5-mm slice thickness through the skull base and posterior fossa. Five-mm thick images were also obtained on the vertex. Contrast medium was administered intravenously in 176 (6.83%) patients after having performed noncontrast scans that demanded its usage. Brain CT images were reconstructed in sagittal or coronal plane using multiplanar projection reconstruction (MPR), and in case of suspected or proved skull fracture cranial bone images were reconstructed using high resolution protocol.

Emergency head CT scans were interpreted, usually off the console, immediately upon examination completion, by the attending radiologist, and were reinterpreted on the next day by the staff neuroradiologist. Emergency brain CT scans were analyzed according to clinical diagnosis, clinical specialties, and need of anesthesiologist's assistance. CT findings were correlated with clinical diagnosis and literature data.

Results

The majority of requests for emergency CT examinations of the head were made by neurologists (n=1441; 55.94%) and neursurgeons (n=632; 24.53%), followed by internists (n=186; 7.22%), surgeons (n=138 (5.36%), and other hospital departments (n=150; 5.82%), whereas 29 (1.13%) such studies were requested by other institutions (Table 3).

Table 3. Distribution of emergency brain CT examinations according to hospital departments

Hospital department	n	%
Neurology	1441	55.94
Neurosurgery	632	24.53
Internal Medicine	186	7.22
Surgery	138	5.36
Pediatrics	41	1.59
ENT	20	0.78
Psychiatry	50	1.94
Other	39	1.51
Other institution	29	1.13

In 2576 patients, emergency brain CT examinations were performed for the symptoms of stroke, SAH, head injury, intracranial expansion or intracranial infection. In 96 (3.73%) patients, the documentation on brain CT studies was lost and unavailable at the time of the study. In the rest of 2480 patients, the results of emergency brain CT scans were as follows: 639 (25.77%) normal and 1841 (74.23%) pathologic findings. In 23 (1.25%) of 1841 pathologic brain CT studies, two coexistent pathologic findings were recorded: head injury and acute ischemic stroke in 15, head injury and acute hemorrhagic stroke in four, head injury and SAH in one, multiple brain metastases and intracerebral hemorrhage in two, and SAH and acute ischemic stroke in one patient. Thus, 1841 pathologic emergency head CT scans revealed 1864 abnormal findings. Out of 1864 pathologic findings, there were 1258 (67.49%) acute changes and 606 (32.51%) chronic changes such as brain infarction in chronic stage, post-traumatic encephalomalacia and gliosis, or changes related to brain aging.

Stroke found in 638 (50.72%) patients was the most common acute pathology; there were 467 (73.20%) cases of ischemic stroke, 47 (10.06%) of hyperacute stroke, and 171 (28.80%) of hemorrhagic stroke.

SAH was identified in 72 (5.72%) and aneurysmatic dilatation of an artery without SAH in four (0.32%) cases, involving middle cerebral artery (MCA) in three and basilar artery in one case.

Head trauma, recorded in 364 (28.93%) cases, included skull fracture with (n=140) or without (n=69) intracranial traumatic lesion, cortical contusion with diffuse axonal injury (n=202), epidural hematoma (n=38), subdural hematoma (SDH) (n=138) including acute SDH (n=116) and chronic SDH (n=22), traumatic SAH (n=114), and diffuse traumatic brain edema (n=70).

Intracranial expansive lesions were found in 160 (12.72%) patients, 105 (8.35%) of them with primary intracranial tumors and 55 (4.37%) with secondary intracranial tumors, including 20 cases of solitary and 35 cases of multiple metastases.

Six (0.48%) patients had infectious diseases of the brain, including brain abscess (n=1), encephalitis (n=1) and granulomatous meningitis due to tuberculosis (n=4).

Obstructive hydrocephalus due to intra-axial or extra-axial masses, aqueductal obstruction, fourth ventricular obstruction, and SAH was found in 11 (0.87%) cases. Results of the pathologic emergency brain CT scans are summarized in Table 4.

Some patients undergoing emergency CT examination are neurologically or/and hemodynamically unstable due to primary disease or multisystem trauma, therefore it is an imperative that vital signs and physiologic functions be

Table 4. Findings recorded on pathologic emergency brain CT examinations

Brain CT finding	n	%
Stroke	638	50.72
brain infarction	467	73.20
brain hemorrhage	171	28.80
Subarachnoid hemorrhage	72	5.72
Head injury	364	28.93
skull fracture without intracranial lesion	69	
skull fracture with intracranial lesion	140	
cortical contusion	202	
epidural hematoma	38	
acute subdural hematoma	116	
chronic subdural hematoma	22	
traumatic subarachnoid hemorrhage	114	
diffuse traumatic brain edema	70	
Intracranial expansive lesion	105	8.35
Metastases	55	4.37
solitary metastasis	20	
multiple metastases	35	
Infectious disease	6	0.48
Obstructive hydrocephalus	11	0.87
Aneurysmatic dilatation of cerebral artery	4	0.32
Rare variations	3	0.24

continuously and appropriately monitored throughout the study. In the present cohort, anesthesiologist's assistance was necessary for extremely restless or life-threatening condition in 296 (9.45%) of 3132 emergency CT examinations, and in 234 (9.08%) of 2576 emergency brain CT examinations.

Discussion

Stroke and head injury have a high incidence in modern societies. Because of the high incidence of consequential disability and new therapeutic approaches, appropriate use of the diagnostic tests available is essential to minimize the cost and to improve the patient outcomes. Therefore, brain CT scanning is an imperative in emergency neurologic and neurosurgical diagnostic patient evaluation.

In the US, approval of tissue plasminogen activator (tPA) for the treatment of acute ischemic stroke within 3 hours of symptom onset has changed the overall approach to acute stroke patients, resulting in the formation of acute stroke teams (ASTs)[1], thus to accelerate the delivery of acute stroke care, and in the development of performance measures for acute ischemic stroke[3] to improve the quality of care. ASTs are an approach to reduce in-hospital delays in obtaining medical care for stroke patients. ATS consists of a selected group of physicians and nurses who have received special training and gained experience in caring for acute stroke patients. The team is usually led by a neurologist, and includes attending physicians, residents and nurses. ATS operates on a 24-hour-*per*-day, 7-day-*per*-week basis, with a group paging system as a special method for rapid notification and very short response time. Physician coverage for these teams is of a rotating basis, so that it does not interfere with other duties.

The emergency department physician performs general patient evaluation, whereas stroke team performs final screening for eligibility, obtains informed consent, and conducts thrombolytic treatment and monitored care at the intensive care unit (ICU). These procedures are incorporated in the stroke performance measures[3]: patients who arrive at the hospital with an acute ischemic stroke with symptom onset of ≤3 hours should be seen by a physician in the emergency room within 10 minutes, by a stroke expert within 15 minutes, and should have head CT scan completed within 25 minutes and interpreted within 45 minutes. CT is immediately interpreted, off the console or off 'hard' copies, by an attending radiologist or by a team leading neurologist alone or with help of a radiologist when there is a question that might affect drug administration.

Subtle signs of acute ischemia on CT include loss of gray-white matter differentiation, mild sulcal effacement, obscuration of the lentiform nucleus, and hyperdense middle cerebral artery sign (HMCAS). Using new generation of higher resolution spiral CT scanners, subtle signs of acute ischemia may be recognized on CT as early as 43 minutes after the event. These CT signs may be very subtle, yet this is when therapeutic intervention has the greatest chance of being successful. The first sign is often subtle cortical hypodensity resulting in the loss of gray-white matter differentiation because of the developing cytotoxic edema induced by ischemia; it may be reversible if perfusion is restored. Recognition of early signs of acute ischemia is also critical to avert complications of thrombolytic therapy: HMCAS is often associated with major neurologic deficit and a poorer response to thrombolytic therapy. CT can therefore help decide who should and who should not receive thrombolytic therapy.

The thrombolytic treatment at ICU starts within 3 hours[3]; it has been shown that tPA can reduce disability and improve functional outcome after stroke[4].

Before ASTs, the average time from stroke onset to hospital arrival was 115 minutes, and times from arrival to examination by a physician and CT scan were 28 to 100 minutes. Community education and the presence of AST have shortened the time to examination by a stroke expert and CT scan by 13 and 63 minutes, respectively, and increased the number of patients admitted to ICU and treated with thrombolytic therapy[1,5,6]. The costs of creating a system for immediate evaluation and management of hyperacute stroke should be minimal and will be offset in longterm by the cost savings of using tPA in the greatest number of eligible patients[7].

According to the stroke performance measures, all patients ineligible for thrombolytic therapy should have head CT or brain MR imaging study within 24 or 72 hours, or within 7 days of admission.

The importance of emergency brain CT is illustrated by our results: during the 24-month period, 1096 (42.55) emergency head CT scans were performed for cerebrovascular symptomatology, 638 (58.21%) of them for stroke. Despite the importance of head CT scanning in emergency neurologic and neurosurgical diagnostic patient evaluation, CT has limitations that should be taken in consideration. CT is usually of no help in the diagnosis of transient ischemic attacks (TIA)[8] and reversible ischemic neurologic deficits. It is of little use in diagnosing acute posterior fossa infarcts, as these areas are often obscured by beam-hardening artifacts from temporal bones. CT may or may not show the extent of infarcts and suggest the etiology. Identification of the potentially reversible ischemic tissue is of critical interest in acute stroke therapy. This is the key to successful thrombolytic therapy, and modern techniques such as CT angiography (CTA), and diffusion weighted technique (DWI) MRI and MR angiography (MRA) have been used to overcome these problems with a variable level of success.

The advent of MRI has significantly changed the use of CT. MRI with DWI, and MRA are currently superior methods for the detection of acute stroke and to show the sequels of infarction such as hemorrhagic transformation, cystic encephalomalacia, gliosis and wallerian degeneration. However, in most institutions CT is available around the clock, whereas MRI is not. Therefore, CT still plays a major role in emergency workup of patients with cerebrovascular disease.

CTA is a widely available technique and is used as part of CT examination to image acute stroke patients. CTA can rapidly visualize the site of vascular occlusion and the length of the occluded segment. CTA is as sensitive to intracranial vascular stenoses and occlusions as MRA and intra-arterial digital subtraction angiography (DSA). Using standard spiral CT scanners, maps of the cerebrovascular flow can be obtained and areas of reduced perfusion and major vessel compromise reliably identified.

Patients with cerebral hemorrhage, either intracerebral hemorrhage or SAH, also benefit from rapid therapy aimed at limiting the extent of the bleed and related complications such as increased intracranial pressure. Drugs that can limit the enlargement of intracerebral hematoma are still in the phase of clinical trials. CTA is important in case of SAH because recent studies showed higher sensitivity of CTA in detecting very small aneurysms compared with intra-arterial DSA[9,10]. In patients with a perimesencephalic pattern of hemorrhage on CT, CTA is the best diagnostic strategy. DSA can only be performed if CTA is negative, and if uncertainty exists about the presence or location of a vertebrobasilar aneurysm on the CT angiogram[11,12]. After confirming SAH on emergency head CT scans, MRA followed by DSA is usually performed at our department.

Although tPA is not yet in use for acute stroke patients in our country, and our hospitals do not have organized ASTs as described above, patients with acute stroke symptoms receive all the necessary therapeutic treatments and medical care at ICUs. All patients presenting with acute stroke symptoms are immediately seen by a neurologist who triage them, according to the severity and duration of symptoms, to ICU or neurologic ward, where they have proper medical treatment and therapy. According to the patient's state and severity of symptoms on admission, head CT scanning is performed immediately or after several hours or days of admission.

In this retrospective analysis, head injury was the second most common reason for emergency CT brain scan. Different traumatic lesions, most of these requiring neurosurgical and/or maxillofacial treatment, were identified in 364 (59%) of 617 cases of head trauma for which emergency head CT scanning was requested. In the literature, brain injury is classified clinically as minimal, minor (also referred to as mild, trivial, moderate), and severe brain injury according to Glasgow Coma Score (GCS), duration of unconsciousness and post-traumatic amnesia, and any focal neurologic findings.

Patients with minimal head injuries (GCS 15) have not suffered loss of consciousness or amnesia, and rarely require admission to the hospital and further diagnostic tests like head CT or MRI. Patients who have suffered severe head trauma and have GCS 12 or less, an obvious penetrating skull injury or obvious depressed skull fracture, an acute focal neurologic deficit, a consciousness disorder, a seizure before hospital assessment, or with unstable vital signs associated with major trauma, require immediate hospital admission, emergency CT brain scan and neurosurgical treatment.

Minor head trauma is characterized by the history of loss of consciousness, amnesia or disorientation and GCS 13-15, however, the use of CT in its evaluation is still controversial. In the US, opinions are divided into three groups: one group think that CT is indicated in all patients with minor head trauma regardless of the clinical findings, whereas the other two groups recommend a very selective approach or suggest that more studies be performed[13]. In Europe and Canada, the use of CT is much more selective for minor head injury. The Scandinavian Neurotrauma Committee suggests guidelines that should be safe and cost-effective for the initial management of minimal, mild and moderate head injuries. According to these guidelines, in patients with mild head injuries (history of loss of consciousness, GCS 14-15), routine early head CT is recommended, and patients with normal scans may be discharged, whereas emergency head CT scanning and admission are mandatory in moderate injuries (GCS 13)[14].

Neurosurgeons in the United Kingdom and Italy have defined acute minor head injuries as 'mild head injuries', and classified these injuries as 'low-risk' (GCS 15, without history of loss of consciousness, amnesia, vomiting or diffuse headache); 'medium-risk' (GCS 15, and one or more of the symptoms mentioned above); and 'high-risk mild head injury' (GCS 14 or 15, skull fracture and/or neurologic deficits). The risk of intracranial hematoma requiring surgical evacuation in patients with low-risk mild head injury is less than 0.1:100, therefore these patients can be referred for home care with written recommendations. The risk of intracerebral hematoma in medium-risk mild head injury is in a range of 1-3:100, therefore CT scan should be obtained in such patients. High-risk mild head injury patients have the risk of intracranial hematoma requiring surgical evacuation in a range of 6-10:100, therefore CT examination must be obtained[15].

Canadians have developed CT head rule or guidelines for the use of CT in patients with minor head injury. The authors have identified five high-risk variables and two additional medium-risk factors that could be used to predict the selected clinical outcomes. They have determined that patients with any one of the following high-risk criteria: GCS <15 within two hours of the injury, suspected or open skull fracture, any sign of basal skull fracture, two or more episodes of vomiting, and age ≥ 65, are at a substantial risk of requiring neurosurgical intervention and that CT examination is mandatory in these cases. High-risk factors were 100% sensitive in predicting the need of intervention. Patients with either of the medium-risk factors, amnesia before impact of more than 30 minutes and dangerous cause of injury, can have clinically important brain injury but no need of surgical intervention. Medium-risk factors were 98.4% sensitive and 49.6% specific in predicting the presence of clinically important brain injury, and their use would require only 54% of patients to undergo CT. The authors suggest that the use of their decision rule could reduce or eliminate the possibility that patients are discharged with an undiagnosed intracranial hematoma and would result in safely reduced CT usage in the management of minor head injury by 25% to 50%, with significant savings to emergency departments[13].

MRI is unequivocally more valuable than CT in assessing the full magnitude of brain injury. It also provides more accurate information on the expected degree of final neurologic recovery. MRI can be performed as the initial examination in stable patients with minor to severe head injury. In unstable patients, however, it is best to delay the examination until they can be safely imaged. It is advisable to perform MRI within the first 2 weeks of the injury, if possible, for better visualization of lesions in this time window.

In case of severe head injury we perform head CT scanning immediately upon neurosurgical examination, whereas for minor head injury CT scanning is performed in cases with documented skull fracture, focal neurologic deficit, or mental status deterioration.

There is a great number of emergency brain CT scans, showing a tendency of steady rise (head trauma, cerebrovascular disorders, new therapeutic approaches). Figure 9 shows the number of emergency brain CT examinations during the 2001-2002 period. Difficulties encountered on CT scanning because of the patient's state, and delicacy of emergency interpretation of CT scans call for greater availability of neuroradiologists within the frame of the emergency state algorithm.

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Sažetak

VRIJEDNOST CT-a MOZGA U HITNOJ SLUŽBI: RETROSPEKTIVNA ANALIZA

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Cilj ove studije bila je evaluacija i radiološko-klinička korelacija CT pretraga mozga u hitnoj službi. Tijekom dvogodišnjeg razdoblja (1. siječnja 2001. – 31. prosinca 2002.) analiziran je odnos hitnih i sveukupnih CT pretraga. Posebno su obrađeni hitni CT pregledi mozga prema kliničkim indikacijama, zastupljenosti pojedinih kliničkih struka i potrebi anesteziološke asistencije. CT nalazi su korelirani s kliničkim upitima i dijagnozama, te uspoređeni s literaturnim podacima. Tijekom 24 mjeseca na Kliničkom zavodu su izvedene 15.933 CT pretrage, od čega 3132 (19,66%) u hitnoj službi (1757 muškaraca i 1375 žena srednje dobi od 56,97 godina). Čak 2576 (82,25%) svih hitnih CT pretraga bile su hitne CT pretrage mozga (1398 muškaraca i 1178 žena srednje dobi od 57,80 godina). Raspoređenost hitnih CT pretraga mozga prema klinikama bila je slijedeća: neurologija 1441 (55,94%), neurokirurgija 632 (24,53%), interna medicina 186 (7,22%), kirurgija 138 (5,36%), ostale klinike 150 (5,82%) i vanjske ustanove 29 (1,13%). Kliničke indikacije za hitnu CT pretragu mozga bile su slijedeće: moždani udar 905 (35,13%), subarahnoidno krvarenje 128 (4,97%), trauma glave 617 (23,95%), poremećaj svijesti i konvulzije 389 (15,10%), intrakranijska ekspanzija 234 (9,08%), glavobolja i/ili vrtoglavica 141 (5,47%), cerebrovaskularna insuficijencija 50 (1,94%), infekcija 46 (1,79%), hidrocefalus 12 (0,47%), metabolične promjene 2 (0,08%) i nedostupni podaci u vrijeme studije 52 (2,02%). Anesteziološka asistencija pri hitnom CT pregledu mozga bila je potrebna u 234 (9,08%) slučaja. Korelacija CT nalaza s kliničkom dijagnozom (kliničkim upitom) pokazala je kako je 96 (3,73%) podataka bilo nedostupno u vrijeme studije, dok je od 2480 preostalih nalaza hitnih CT pregleda mozga bilo 639 (25,77%) normalnih i 1841 (74,23%) patoloških. Provedena je i usporedba s podacima iz literature. Zaključeno je kako je velik broj hitnih CT pretraga mozga s tendencijom stalnog porasta (cerebrovaskularne bolesti, novi terapijski pristupi, trauma glave). Otežano izvođenje pretrage zbog teškog stanja bolesnika i osjetljivost hitne interpretacije nalaza nameću potrebu veće dostupnosti neuroradiologa uz pridržavanje algoritma pretraga u hitnim stanjima.

Ključne riječi: *Mozak – radiografija; Bolesti središnjega živčanog sustava – radiografija; Tomografija – rendgenska – kompjutorizirana – primjena; Hitna stanja; Hitna služba – bolnica*

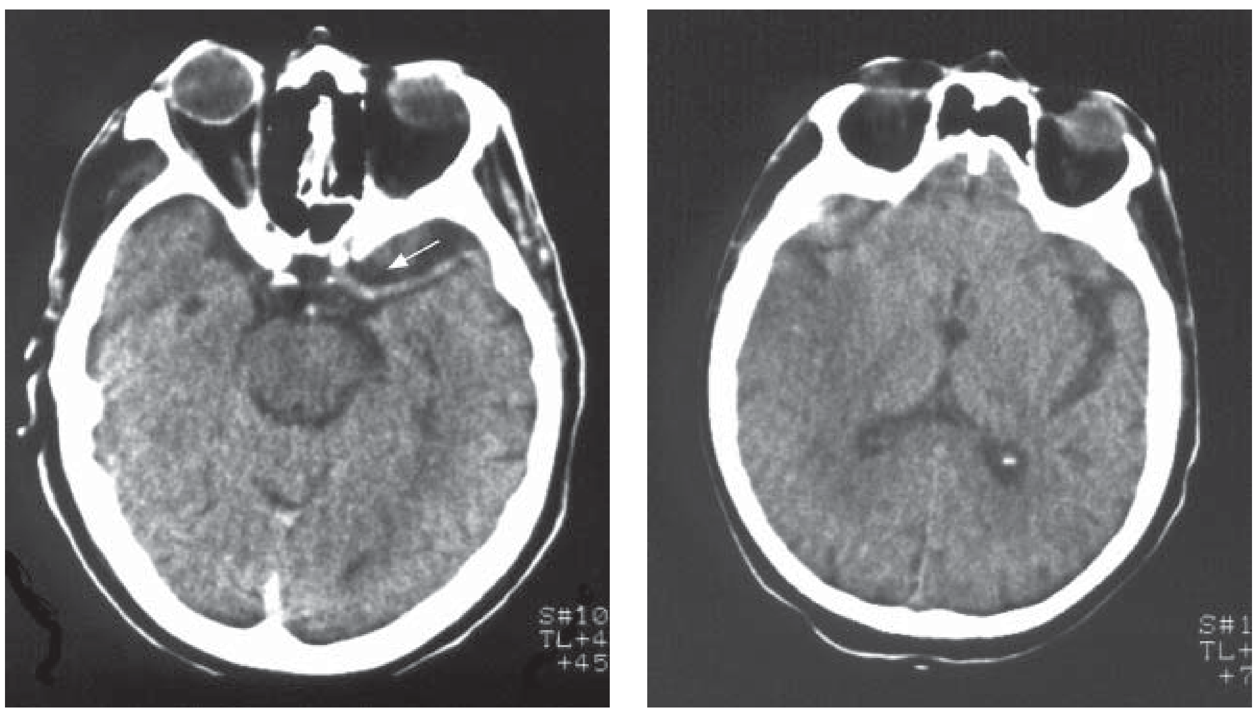

Fig. 1. Acute left middle cerebral artery infarction – 4 hours after the symptom onset: (a) hyperdense middle cerebral artery sign (arrow); (b) loss of gray-white matter differentiation in the left lateral insular cortex, and mild effacement of the left Sylvian fissure.

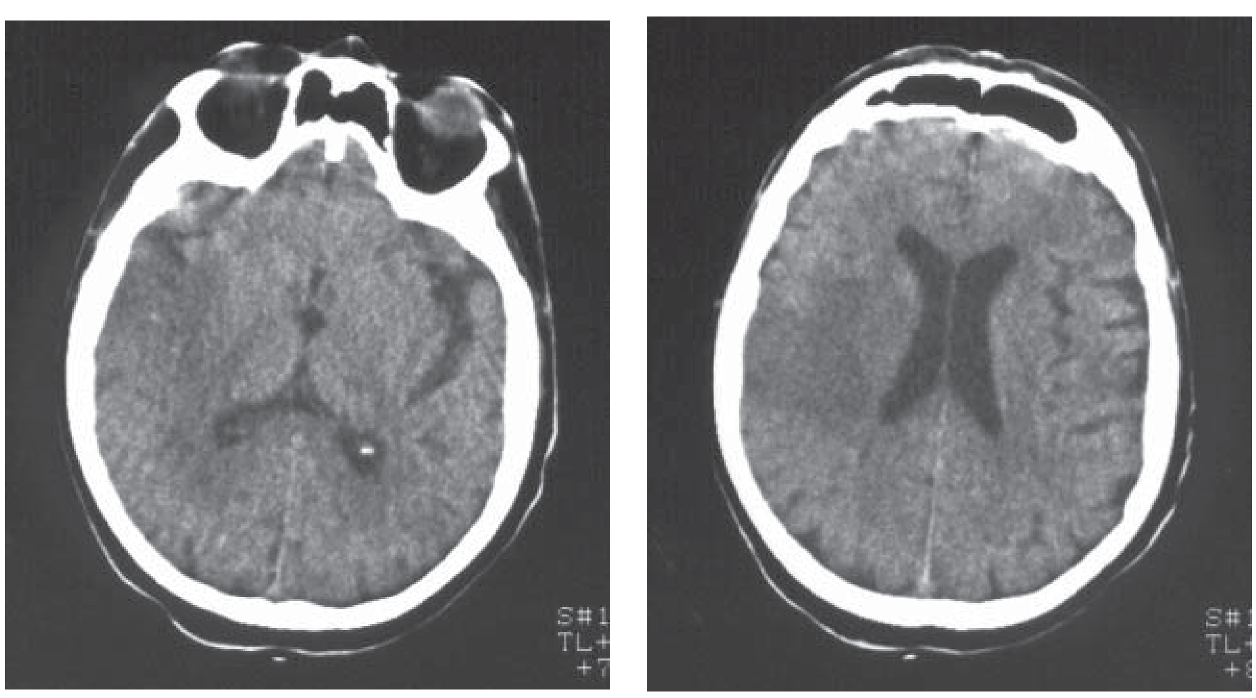

Fig. 2. Acute right middle cerebral artery infarction – within the first 24 hours of the acute ischemia: (a) hypodensity of the infarction, marked right parietal sulcal effacement, mild right lateral ventricular compression; (b) hypodensity of the infarction, marked right temporoparietal sulcal effacement.

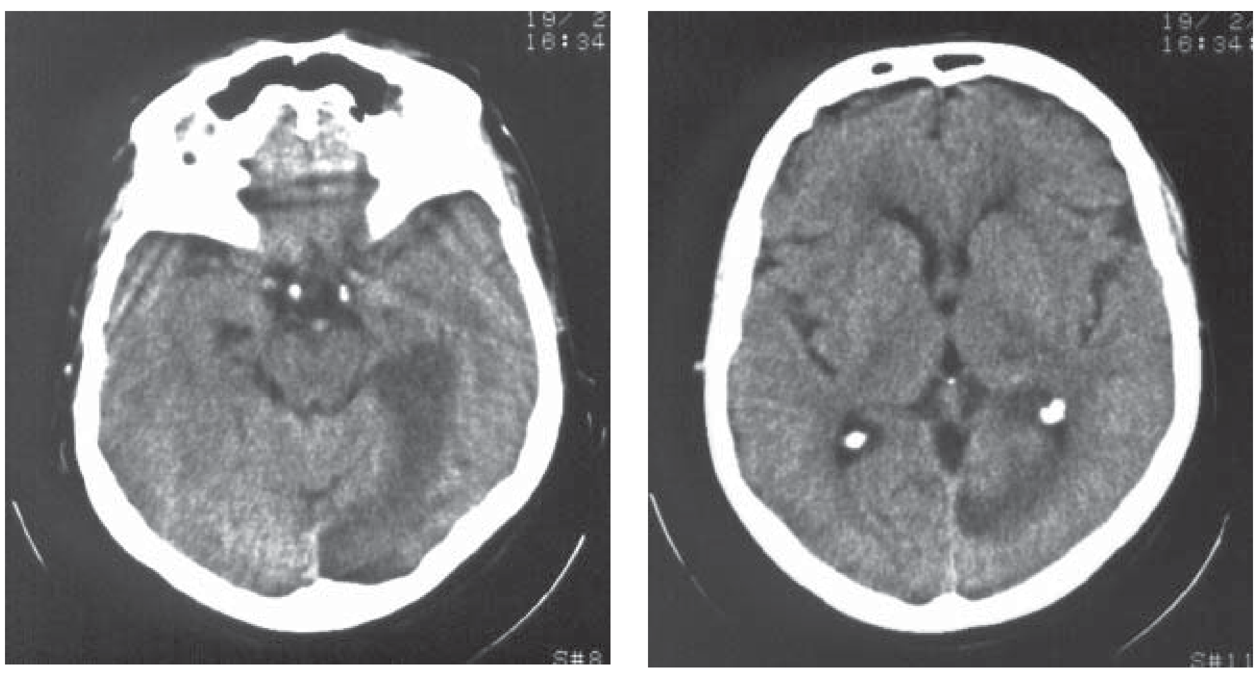

Fig. 3. Subacute left posterior cerebral artery infarction (a), and (b) wedge shaped left occipital hypodensity of the infarction.

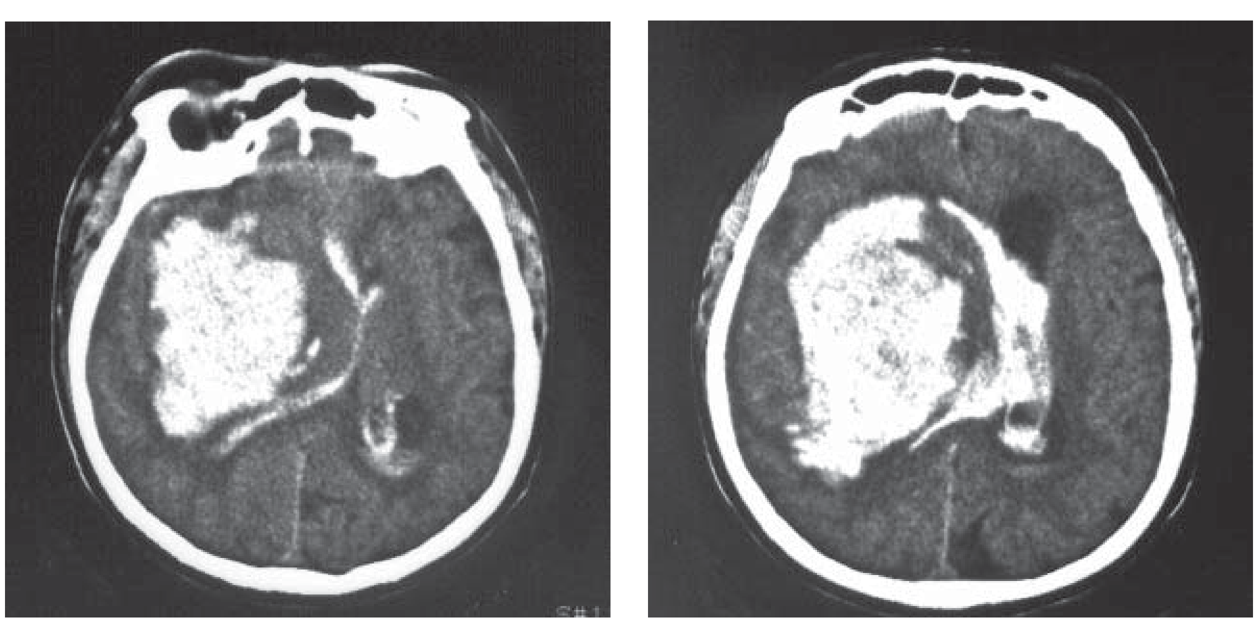

Fig. 4. Massive intracerebral haemorrhage of the basal ganglia with (a), and (b) marked mass effect of the hematoma with ventricular compression and midline shift, and intraventricular blood.

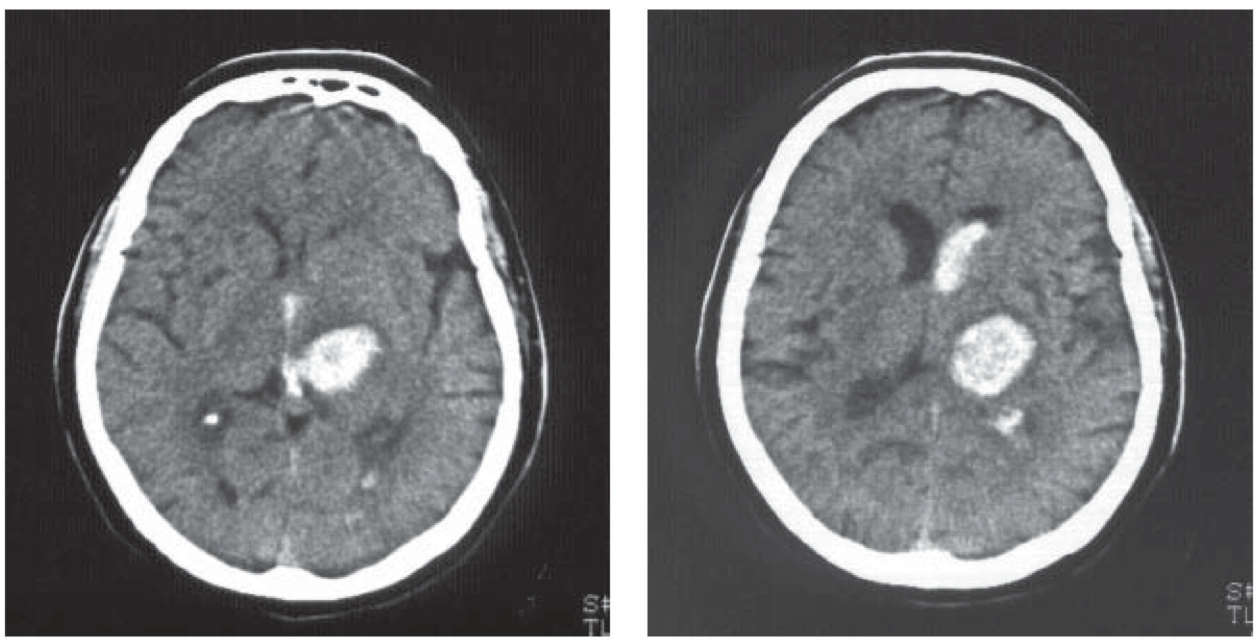

Figure 5. Acute thalamic hematoma with intraventricular blood: (a), and (b).

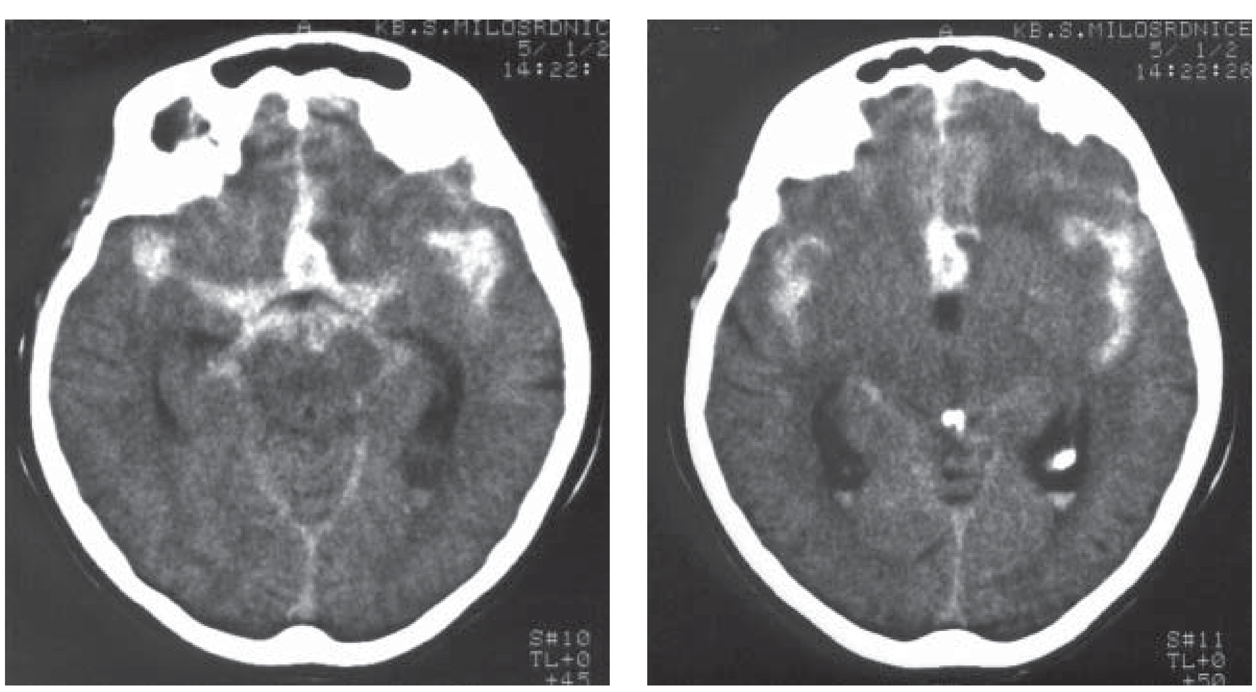

Figure 6. Acute subarachnoid haemorrhage with (b) intracerebral hematoma, and (a, b) intraventricular blood.

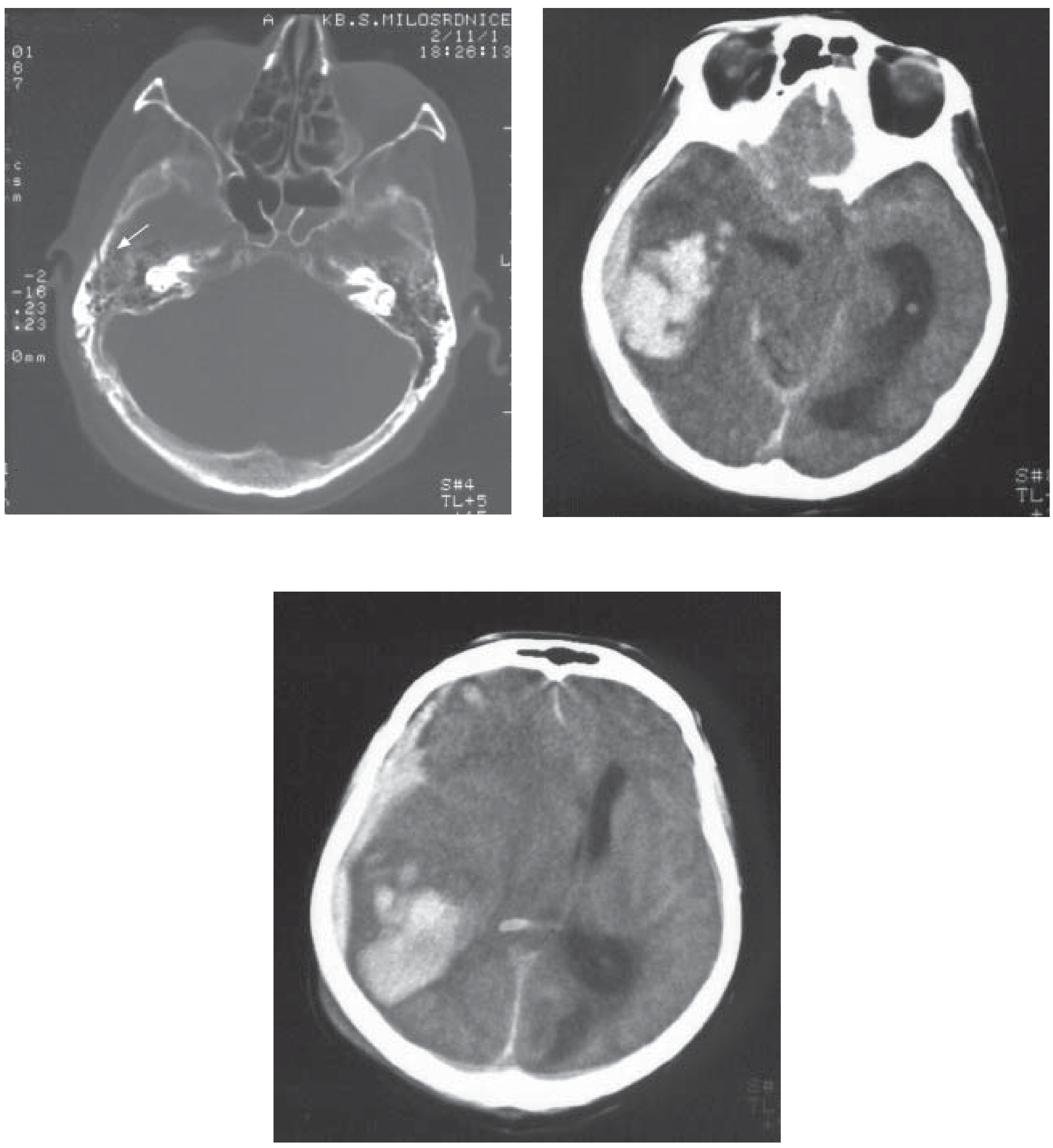

Fig. 7. Head trauma: (a) skull base fracture (arrow); (b) and (c) epidural, subdural and intracerebral hematomas, traumatic subarachnoid hemorrhage (intraventricular blood), multiple hemorrhagic contusions, and herniation through the tentorial incisure.

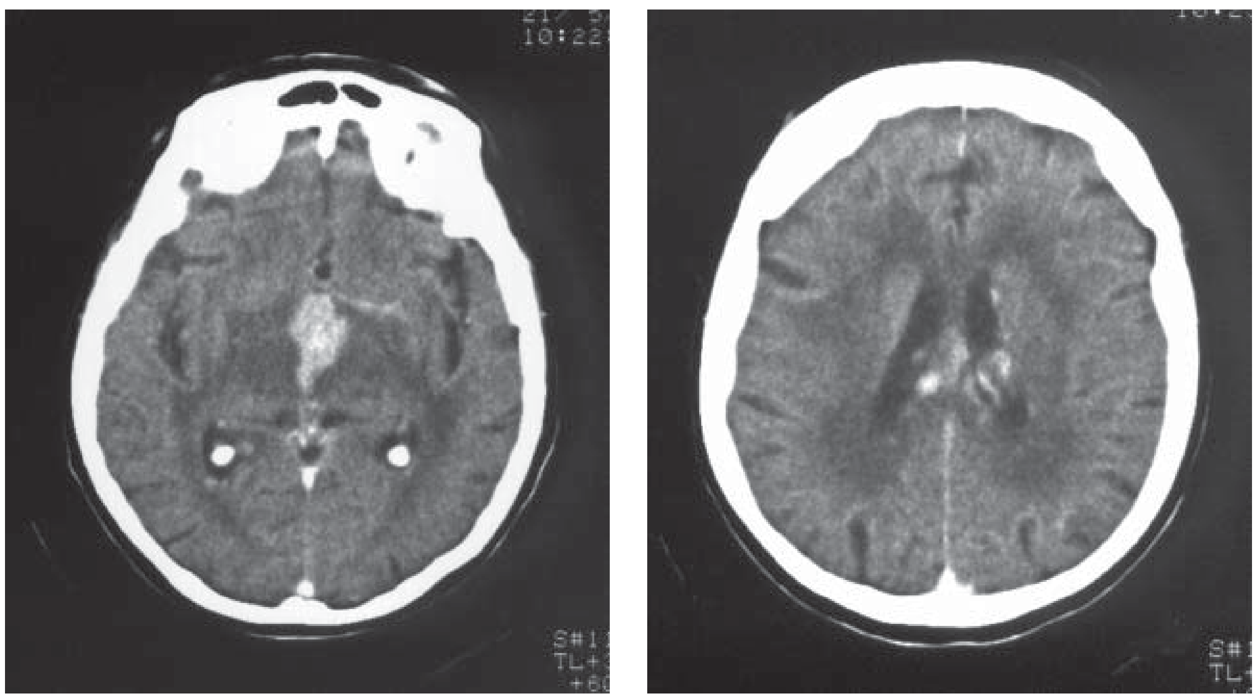

Fig. 8. Intracranial tuberculosis (contrast enhanced scans): (a) intracranial tuberculoma, and (b) tuberculous meningitis affecting lateral ventricle.

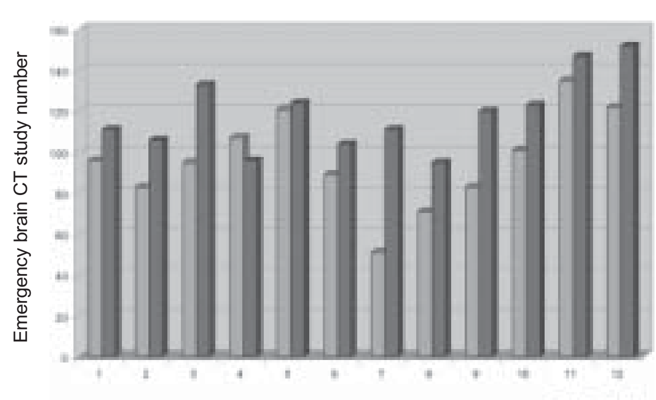

Fig. 9. Emergency brain CT examinations during 2001 and 2002.