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Subdural Effusions: Determination of Contrast Medium Influx from CSF to the Fluid Accumulation by Computed Tomography as an Aid to the Indications for Management

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Summary

In 46 patients with subdural effusions CSF dynamics and especially the influx of contrast medium from CSF to the subdural fluid accumulation was investigated by serial computed tomography (CT). In 16 cases the subdural effusion was of traumatic and in 30 cases of non-traumatic origin.

The results allowed a subdivision of the patients into three groups.

Group 1: patients without contrast medium influx into the subdural fluid accumulation; group 2: patients with delayed influx; group 3: patients with immediate influx.

In group 1 patients the subdural effusion acted as a space-occupying process with absolute indication for surgical treatment.

Also in group 2 patients the further course showed that a surgical indication was given, because the fluid accumulation did not resolve under conservative management but increased in size, and/or the neurological deficit worsened.

In all group 3 patients the subdural effusions decreased and finally disappeared conservatively.

Group 1 patients with effusions on traumatic origin generally had more severe injuries than the patients of the other groups.

The investigations caused no serious complications.

This diagnostic method proved to be a reliable means for early differentation between the possibility of conservative mangement or the indication for operative treatment in cases with subdural effusions of different origin.

Keywords: Subdural effusions; conservative management; operative indication; CSF dynamics; CT.

Introduction

In recent years a whole host of publications has appeared on the pathogenesis, diagnosis and therapy of subdural effusions. Although the diagnosis of subdural effusions has been significantly facilitated by the advent of computerized tomography (CT), deciding upon the correct therapeutic approach remains basically as difficult as ever. However, examination by CT reveals even more frequently – often as an incidental finding – clinically asymptomatic subdural accumulations of fluid of the same density as CSF.

In cases in which no clinical symptoms warrant surgical treatment so far only CT-follow-up allowed the detection of enlargement of the effusion.

The objective of the present study was to examine the communication between subdural effusion and CSF space by CT after lumbar injection of a positive contrast agent to clarify in which cases operative treatment is indicated.

Material and Methods

Patient Material

Forty six patients were selected for participation in the study. In all cases it was impossible to establish reliably from the native CT scans whether true compressive subdural effusions or merely expansion of the subarachnoid spaces were present. The following categories of patients were excluded from the study:

1. Newborn babies, because subdurography by fontanelle puncture is a less stressful and technically simpler procedure in such patients.
2. Patients in whom the indication for surgery could be readily confirmed on the basis of the native CT scans and the clinical status.
3. Unco-operative patients.

In all our patients the subdural effusions were broadest in the frontal region on one or both sides. In five cases the entire hemisphere was affected, and in three the effusion had spread into the interhemispheric space too.

Methods

Patients with convulsive disorders were premedicated with 1 mg clonazepam. Allergic patients were given 250 mg prednisolone 21-hemisuccinate sodium 10 mg as a prophylactic measure.

Depending on body weight each patient was given an injection of not more than 10 ml 40.82% aqueous solution of iopamidol (Solutrast 200 M), except in 1982, when two patients were given 3.75 g metrizamide (Amipaque) in isotonic solution (the study was performed between 1982 and 1990).

After injection of the contrast agent the patients remained lying down with the head tilted back at an angle of about 30° for 10–15 min. The patients were instructed to rest in bed for six hours after the puncture.

A CT scan of the brain was carried out after 6, 18, 24, and 48 h.

The Siemens Siretom 2000 system was used from 1982 until 1985 and thereafter the Picker International Synerview 1200 SX.

When evaluating the CT scans, particular attention was paid to the following points:

1. The progress of the contrast agent into the basal cisterns, to the subarachnoid space of the convexities and to the ventricular system and the subdural space.
2. The identifiability of presumed subarachnoid space on the one hand and subdural space on the other.
3. The course of the influx (if any) of the contrast agent into the subdural space from the subarachnoid space.

At a later date we attempted to establish whether there was any correlation between the findings of the examination and the eventual need for surgery and whether the effusions worsened or improved.

As a secondary factor any evidence of possible pathogenetic factors was noted. We also evaluated the results of the scans with reference to the antecedent history.

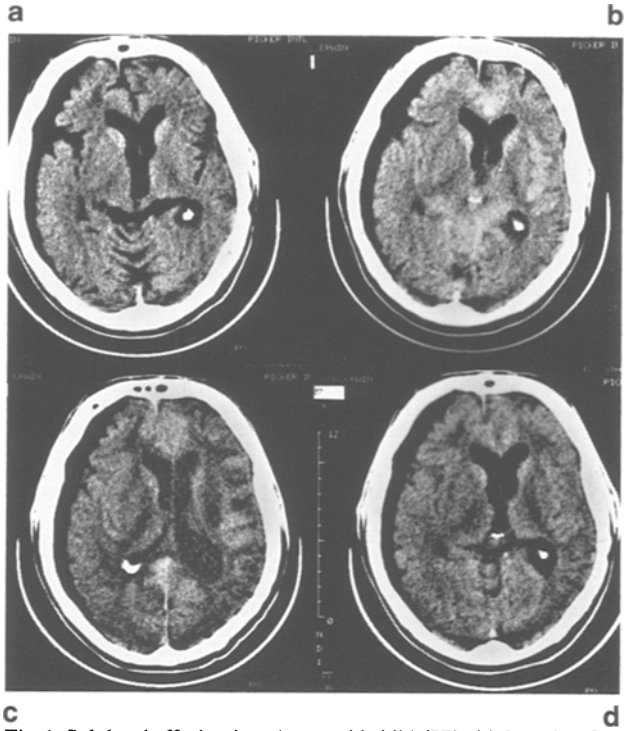

Fig. 1. Subdural effusion in a 4-year-old child (PP). (a) 3 weeks after drainage of a subdural haematoma by a small craniotomy in the left temporal region. No influx of contrast agent into the subdural effusion. (b) 6 h after injection of contrast agent, (c) 15 h after injection of contrast agent, (d) 24 h after injection of contrast agent

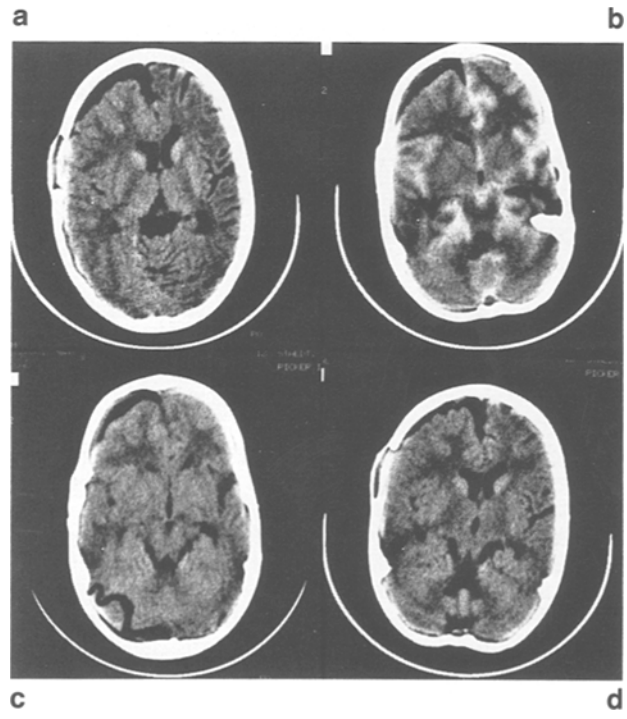

Fig. 2. Subdural effusion in a 53-year-old patient (GE) after craniocerebral trauma with fracture (temporo-parietal, left) and contusions (fronto-basal, left). (a) CT on day 15 after the trauma. (b – d) CT 6, 18, and 24 h after injection of contrast agent; no influx of contrast agent into the effusion but the agent can be seen passing through the subarachnoid space of the convexities and in the ventricular system; no absorption disturbances evident

Results

CT Findings

The patients were subdivided into the following groups on the basis of the time taken by the contrast agent to appear in the subdural effusion:

Group 1: no influx of contrast agent; 23 patients (Figs. 1 and 2).

Group 2: delayed influx of contrast agent; 9 patients (Fig. 3).

Group 3: immediate influx of contrast agent; 14 patients (Fig. 4).

In the follow-up of group 1 and 2 between this investigation and the operative treatment there was an increase of the effusions in 17 cases in group 1 and in 4 cases in group 2. There was an increase of the neurological deficit in 16 cases in group 1 and in 5 cases in group 2; an increase of the effusions as well as of the neurological defict in 10 cases in group 1 and in 1 case in group 2. All of these patients in group 1 and 2 had to be operated upon after 5 to 36 days. Only the

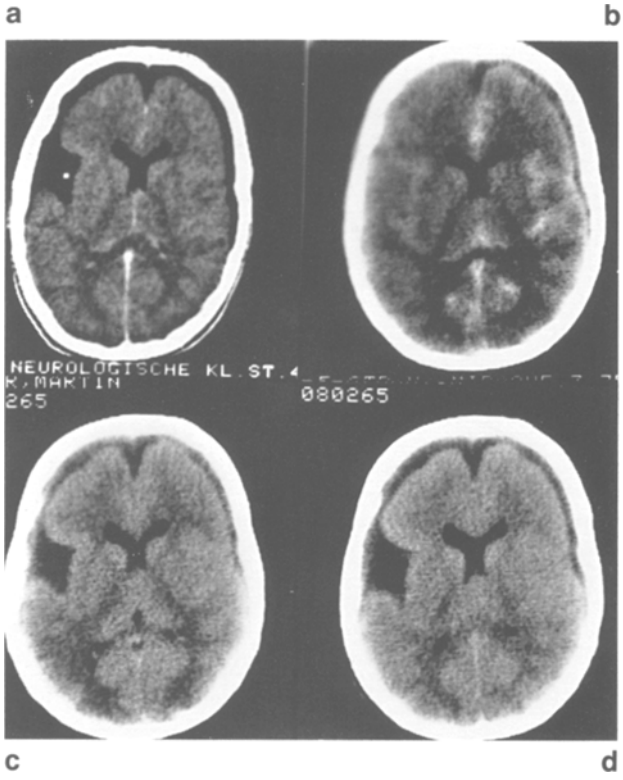

Fig. 4. Subdural effusion in a 58-year-old patient (SK). (a) Effusion becomes visible for the first time in the CT scan on day 6 after the trauma. (b – d) CT scans 6, 18, and 24 h after injection of contrast agent; immediate influx of contrast agent into the subdural effusion, free communication between subarachnoid and subdural space

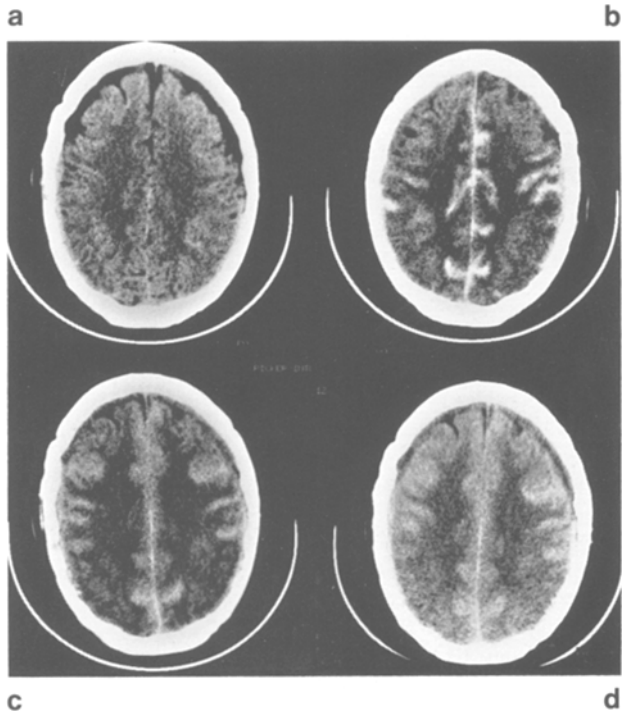

Fig. 3. Subdural effusion in a 17-year-old patient (BM). (a) 23 rd day after craniocerebral trauma: no CT-detectable traumatic damage to the brain, but injury-independent subarachnoid cyst right temporal. (b – d) CT scans 5, 18, and 24 h after injection of contrast agent; left: delayed influx of contrast agent into the effusion; right: immediate influx of contrast agent both into the subarachnoid cyst and into the subdural effusion

patients in group 3 responded satisfactorily to conservative treatment.

Discussion

In the literature two main pathogenetic factors responsible for subdural effusion are discussed: traumatic rupture of the arachnoid with consequent valvular function (Naffziger, 1924[20], Loew, 1982[17]) and disturbed permeability of the dural vessels (Loew, 1982[17]).

The mere fact that subdural effusions are almost invariably localized frontally proves that an effusion is not caused by either one of these factors on its own, the intracranial pressure situation and the dynamics of the cerebrospinal fluid also play an important part (Loew, 1982[17]).

Untill recently the indication for conservative or operative management of subdural effusions in most cases depended on clinical and CT follow-up, enlargement of the effusion and/or neurological deterioration being the criteria for operative treatment. Only on the rare cases of clearly space-occupying subdural cysts was it possible to base the operative indication on a single CT only. Moreover the question remained open why subdural effusions regressed spontaneously in some patients but worsened in others.

The objective of the present study has been to obtain – with the aid of CT imaging of CSF dynamics – differential-diagnostic information which helps to identify cases in which surgery is indicated.

The patients in whom the contrast agent failed to enter the subdural effusion (group 1) all required surgical treatment because the effusion enlarged and/or the neurological situation deteriorated.

Also all patients with delayed contrast entry (group 2) during follow-up developed signs which indicated the need for surgery.

Perhaps in some cases of group 2 the valvular function of the traumatic rupture of the arachnoid is intermittent depending on the intracranial pressure situation.

The patients who exhibited immediate influx of contrast agent into the subdural effusion (group 3) re-

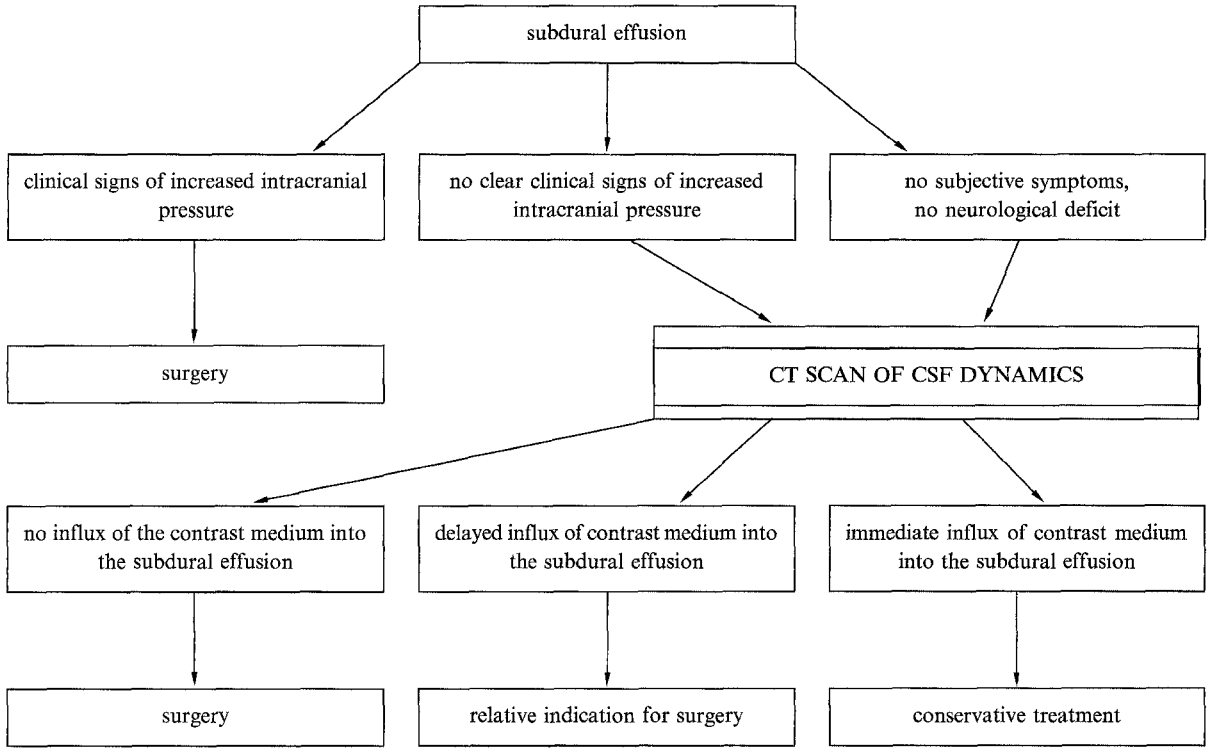

Fig. 5. Significance of CT examination of CSF dynamics in subdural effusion

sponded sufficiently well to conservative management and did not require subsequent surgery. Perhaps in some of these cases the effusions (group 3) were not really subdural effusions but only an enlargement of the subarachnoid space.

The more rapid the influx of the contrast agent into the subdural effusion, the freer the communication between the subdural effusion and the subarachnoid space, the greater was the chance of spontaneous regression of the effusion.

The CT imaging of CSF dynamics helps to identify cases in which surgery is indicated for subdural effusions avoiding the necessity of long-term CT-control follow-up (Fig. 5).

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