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Computed Tomography Features Immediately After Replacement of Haematoma with Oxygen Through Percutaneous Subdural Tapping for the Treatment of Chronic Subdural Haematoma in Adults

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Summary

In an effort to achieve a simple and less invasive method for the treatment of chronic subdural haematoma, replacement of the haematoma with oxygen by percutaneous subdural tapping was employed in 36 patients. This study was conducted on 23 haematomas in 20 patients, whose computed tomography (CT) scans immediately following the treatment were available for evaluation, with particular regard to distinguishing between their findings and those seen with tension pneumocephalus. The CT features werde divided into two patterns according to the location of oxygen; a convexity type (19 haematomas) and an interhemispheric type (4 haematomas). Analysis of the CT appearances revealed the oxygen was exclusively confined to the haematoma cavity, distinguishing it from the findings in tension pneumocephalus. This observation indicates the safety of replacement of the haematoma with oxygen when combined with our percutaneuous subdural tapping technique which prevents lesions of the inner haematoma membrane.

Keywords: Chronic subdural haematoma; subdural tapping; oxygen; tension pneumocephalus; computed tomography.

Introduction

After the advent of computed tomography (CT) scanning, which ensured accurate localization of intracranial haematomas, therapeutic modalities for chronic subdural haematoma became simpler and less invasive[5, 9]. Since 1978, the authors have performed percutanous subdural tapping for the management of chronic subdural haematoma in adult patients[1, 2]. Among the techniques using percutaneous subdural tapping, replacement of the haematoma with oxygen came to be employed more frequently because of its simplicity and reliability. This technique, however, was criticized because of the possible occurrence of tension pneumocephalus based on the postoperative CT findings. In this study, the authors evaluated the CT features immediately after replacement of the haematoma with oxygen, and discuss the distinction from the features in tension pneumocephalus.

Subjects and Methods

Over a 7-year period form 1985 through to 1991, 36 adult patients with chronic subdural haematoma underwent replacement of the haematoma with oxygen by percutaneous subdural tapping at the bedside. This study was conducted on 23 haematomas in twenty patients (bilateral haematomas in 3 patients), whose CT scans immediately following the treatment were available for evaluation. The age of the patients ranged from 33 to 86 years, with an average of 66 years. There were 16 men and 4 women. All patients were followed up for more than 6 months.

The technical aspects of this procedure have been described previously[1, 2], but the essential parts are briefly outlined as follows. Percutaneous subdural tapping is performed under local anaesthesia at the bedside using a subdural needle devised by one of the authors (19 gauge, Muraishi Iryoki, Tokyo, Japan). After the cessation of spontaneous drainage of the liquid haematoma, 10 ml of oxygen is slowly injected into the haematoma cavity. Then, 10 ml of the liquid haematoma is aspirated. This procedure is repeated until no more haematoma can be obtained. In order to keep the pressure in the haematoma cavity equal to atmospheric pressure, the amount of oxygen injected and the haematoma aspirated is controlled during the procedure. Finally, a short duration (usually 30 minutes) of subdural drainage is placed to allow the egress of oxygen and residual haematoma.

Results

Neurological recovery after the treatment was satisfactory in all 20 patients without complications related to replacement of the haematoma with oxygen. A CT scan immediately after the procedure confirmed that the majority of the haematoma was replaced by oxygen in all patients. The CT features were divided into two patterns according to the location of oxygen: a convexity type, in which oxygen is confined over the

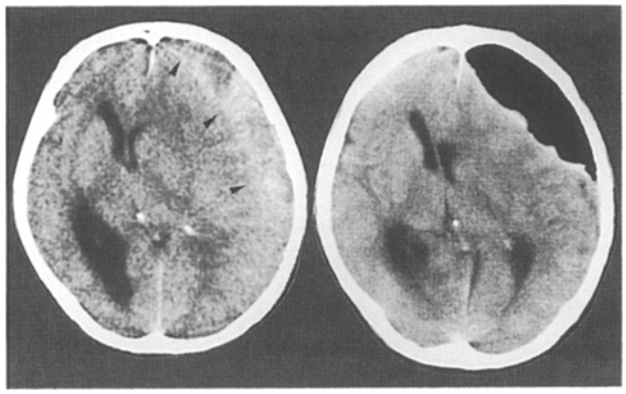

Fig. 1. Pre-(left) and postoperative (right) computed tomography scans in a unilateral convexity type. Note complete replacement of the haematoma (arrowheads) with oxygen. No oxygen is observed in the subarachnoid spaces or the subdural spaces extending beyond the haematoma cavity

Fig. 2. Pre-(left) and postoperative (right) computed tomography scans in a bilateral convexity type. Note complete replacement of the haematoma (arrowheads) with oxygen

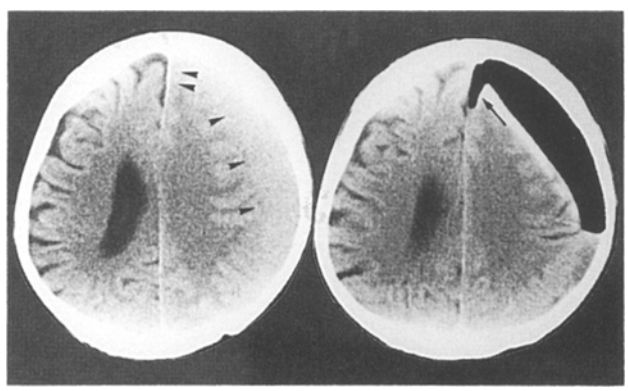

Fig. 3. Pre-(left) and postoperative (right) computed tomography scans in an interhemispheric type. Note the location of the haematoma (arrowheads) involving the interhemispheric space, and oxygen in the interhemispheric region (arrow), showing the feature of the peaking sign

Table 1. *Classification of the Location of Oxygen Immediately Following Replacement of Chronic Subdural Haematoma*

Pattern of the location of oxygen	No. of haematomas
Convexity type	19
Interhemispheric type	4
Total	23

cerebral convexity (Figs. 1, 2), and an interhemispheric type, in which oxygen extends into the interhemispheric space (Fig. 3). No oxygen was observed in the subdural spaces beyond the haematoma cavity or in the subarachnoid spaces. The results of the CT features are listed in Table 1.

Discussion

Tension pneumocephalus is a well-known complication after the treatment of chronic subdural haematoma in adults[3–5, 8], though the incidence is very low and most postoperative gas collection is noncontributable. As characteristic CT appearances showing tension pneumocephalus, the peaking sign[8] and the Mt. Fuji sign[4] have been described. Recently, Nagata *et al.* re-evaluated the CT features showing the peaking sign and the Mt. Fuji sign in patients with symptomatic tension pneumocephalus. They elucidated that pneumocephalus after the treatment of subdural haematoma became symptomatic in patients complicated by migration of air into the subdural and/or subarachnoid spaces beyond the haematoma cavity[7].

To establish a simple and reliable method for the treatment of chronic subdural haematoma, the authors have used replacement of the haematoma with oxygen by percutaneous subdural tapping[2]. Although satisfactory results have been obtained with this procedure, a criticism was cast on the possible development of tension pneumocephalus because of postoperative CT findings of a large amount of gas collection. Although intracranial oxygen is absorbed more easily than air, our experience failed to show any substantial difference between oxygen and air in influencing the clinical course. In this study, the CT features immediately following the treatment were divided into two patterns: a convexity type and an interhemispheric type. The latter appeared to have a similar cerebral contour to that seen in the peaking sign and the Mt. Fuji sign.

However, comparison of the pre- and postoperative CT findings disclosed that oxygen in our series was exclusively confined to the haematoma cavity without migration into the subdural or subarachnoid spaces.

The currently standard method of burr-hole evacuation necessitates physiological saline irrigation through a catheter inserted into the haematoma cavity, by which the inner capsule may be injured thereby allowing migration of air into the subdural and/or subarachnoid spaces[7]. In this respect, percutaneous subdural tapping has no risk to penetrate the inner membrane because the tip of the needle remains just beneath the outer membrane of the haematoma cavity[1, 2]. This technique precludes the development of tension pneumocephalus, consequently ensuring the safety of this procedure.

In conclusion, the CT features after replacement of the haematoma with oxygen are in part similar to those with tension pneumocephalus. Since oxygen is more easily absorbed than air and because the percutaneous subdural tapping method obviates a lesion of the inner haematoma membrane allowing no oxygen to escape into the subdural or subarachnoid spaces, this procedure is not complicated by symptomatic tension pneumocephalus.

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