504

IMPACT OF MR-IMAGING IN THE ASSESSMENT OF "INNER CEREBRAL TRAUMA"

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In closed head trauma the neuropathological pattern of axonal injuries within the brain stem, corpus callosum and deep white matter ("inner cerebral trauma") is incompletely delineated by CT due to relative insensitivity towards small non hemorrhagic lesions. In order to evaluate the impact of MRI in the assessment of inner cerebral trauma 76 patients with severe head injury were investigated between 1989 and 1990. All examinations were performed on a 1.5 Tesla Magnetom using T1 (550/15/TR/TE) and T2 (2400/15/90) as well as 3D gradient echo sequences (40/5/alpha = 40 degrees). All patients had been monitored by continuous pulse oximetry, capnography, ECG and blood pressure manometry. 45 examinations were performed in general anesthesia.
MR-imaging detected more lesions than CT in all patients and came close to neuropathological distribution. 3D gradient echo sequences allowed a better detection of even small lesions within the corpus callosum and the brain stem due to reduced partial volume averaging. The pattern of the lesions was evaluated with especial respect to the direction of the traumatising forces. MR-imaging allowed a better differentiation between primary and secondary posttraumatic lesions. Whereas CT remains sufficient in the initial surgical management, MRI will be the modality of choice for prognostic consideration and conservative management, as well as for further understanding of pathomechanism of cerebral trauma.

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THE HISTOLOGIC CORRELATE OF WHITE MATTER AND PERIVENTRICULAR MRI SIGNAL HYPERINTENSITIES

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Mixed and T2-weighted magnetic resonance imaging (MRI) sequences frequently display unexpected areas of periventricular (PVH) as well as deep and subcortical white matter hyperintensity (WMH). The pattern and extent of such changes may be quite variable and their cause and clinical significance are still controversial. We therefore compared the imaging results and pathologic findings on the brains of 10 elderly patients who had undergone MRI shortly before death.
In general there was no correlate to the hyperintense caps around the ventricular horns and punctate WMH by only visual inspection of 5 mm thick brain slices obtained parallel to the MRI plane. Histology revealed areas of edema around large white matter veins, a rarefication of fibers and a varying degree of demyelination in the former. The extension of such changes alongside the lateral ventricles was reflected on MRI by a band of PVH. Punctate WMH, when identified, consisted mostly of subtle perivascular tissue changes with a varying degree of edema, demyelination and gliosis around both small arteries and veins. Larger hyperintensities tended to contain small central lacunes and there was evidence for marked small vessel disease characterized by multiple infarcts and spongiform changes of the white matter in cases with irregular PVH and confluent WMH.
Our findings provide further evidence for the vascular origin of WMH but suggest a different etiology for periventricular high signal intensity caps and bands.

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MULTIPLE SCLEROSIS: CORRELATION OF NEUROPATHOLOGICAL FINDINGS WITH PRE- AND POSTMORTEM MRI

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Since formalin-fixed brains of multiple sclerosis (MS) patients have been demonstrated to show similar lesions as seen in vivo for other patients (Stewart WA et al.:Lancet 1984: 412; Nagara et al: J. Neurol Sci 1987: 67), few further comparisons of neuropathological data and postmortem MRI-scans have been made.
To our knowledge, this is the first report comparing pre-and postmortem MR-scans with neuropathological findings in a case of clinically definite MS.
A 55 year-old female patient had a four year history of chronic progressive paraparesis preceded by several episodes of optic neuritis. She was hospitalized because of a hip fracture and her neurological state had been stable. The CSF analysis had shown an increased intrathecal IgG production and oligoclonal bands. Visual evoked potentials showed a prolonged P100 on both sides. An MRI scan had confirmed the diagnosis six weeks before her death due to pulmonary embolism.
The brain was fixed in a 10% formalin solution and post-mortem scans were made with transversal SE sequences according to the premortem cuts (0.5 Tesla). The dissection of the brain was performed in corresponding planes and selected areas of interest were taken for histological stainings. Extensive periventricular demyelination, shadow plaques and one plaque in the brain stem are compared with the in-vivo and postmortem scans.

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PREVALENCE AND FOLLOW UP OF WHITE MATTER AND PERIVENTRICULAR MRI HYPERINTENSITIES IN ASYMPTOMATIC VOLUNTEERS

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Unexpected lesions in the brain parenchyma, particularly in the white matter are often seen on magnetic resonance imaging (MRI) of patients studied for various clinical reasons. In order to provide further information on the prevalence and extent of these white matter (WMH) and periventricular hyperintensities (PVH) in the "normal" population, we prospectively studied 101 asymptomatic volunteers ranging in age from 31-84 years (mean 55 years). Follow up studies were obtained in 29 individuals after a mean of 15 months.
WMH were present in 48% of the study subjects and most of them were identified as punctate foci. Their prevalence showed a strong age related increase from 11% in the fourth decade to 71% in those individuals 70 years or older. Moreover, WMH were detected significantly more often at the presence of cerebrovascular risk factors ($p<0.05$). PVH were observed in 45% and consisted predominantly of caps and/or lines. Their prevalence also increased with age but was not related to the presence of risk factors. More prominent WMH and PVH were seen in 6% and 4% of subjects, respectively, and were associated with higher age and cerebrovascular risk factors. Follow up studies did not reveal an increase of size in any of the lesions and only small fluctuations in respect to the lesion number.
Our study indicates a high prevalence of WMH and PVH even in clinically asymptomatic individuals.

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REPRODUCIBILITY OF HMPAO - BRAIN UPTAKE I. Podreka, S. Asenbaum, T. Brucke, S. Wenger, W. Lang, G. Goldenberg, M.

is study was undertaken in order to investigate, if quantitative data on CBF can be obtained in the same subject from HMPAO-SPECT investigations.

Repeated SPECT studies separated by 8.6 ± 4.4 days were performed in 17 subjects 49.6 ± 16,9 years of age (5 normals, 12 patients with peripheric neurological or chronic CNS diseases). After system calibration (dual head gamma camera), counts in SPECT slices could be converted into Ci. For global HMPAO-uptake estimation, pixels of single slices (3.125 mm thick) which contained 36% or more of the maximal pixel content were summed together. Multiplication of the pixel sum by the pixel volume gave the brain size in ml. HMPAO-uptake was then expressed in % of the injected dosis/100 ml brain tissue. For regional HMPAO-uptake evaluation a total of 17 ROIS/hemisphere, covering predominantly gray matter, were drawn on 4 adjacent 21.9 mm thick transversal sections. Correlation and regression analysis was used for statistical evaluation.

Global and hemispheric HMPAO-uptake values were highly reproducible (r=0.957, r=0.947, r=0.955 respectively, all $p < 0.001$). %-difference of global HMPAO-uptake in the two measurements was 0.167 ± 6.0%, for the left hemisphere 0.615 ± 6.7% and 0.493 ± 6.3% for the right hemisphere. Regional correlation coefficients were all significant (r=0.881 to r=0.973, all $p < 0.001$). However %-difference varied between 6.7% and 25.2% through the regions. The highest variation was recorded in small ROIS over the central or mesiotemporal cortex or the thalamus.

As our data show, calculation of %-HMPAO brain uptake from SPECT images is reproducible. The best results were obtained, as expected, for global and hemispheric tracer uptake. The maximal difference between two studies was 12.7%, which is also known to be for PET studies separated by 1-8 days. The ROI size, cortical atrophy, as well as the slight variations in repositioning of the subjects were mostly responsible for regional uptake differences. Considering these results, the described method can be used routinely for the approximative calculation of intraindividual CBF changes caused by drugs or by neurophysiological stimulation.

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BRAIN SPECT USING A BENZODIAZEPINE(BZD)-RECEPTOR-LIGAND (IOMAZENIL)

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Specific receptors are thought to mediate the various pharmacological effects of BZD administered for therapeutic purposes. These receptors may either be changed reversibly in hepatic encephalopathy and seizures or altered irreversibly in degenerative disorders. BZD receptors were imaged by SPECT with Iomazenil (I). After i.v. injection, the initial regional uptake in the brain tissue depends on regional blood flow. Later, regional distribution of BZD receptors. A SPECT study done within a period of 15 minutes post i.v. injection of I therefore permits tomographic imaging of regional blood flow in analogy to other CBF markers. A delayed SPECT scan performed 120 minutes post injection shows the distribution of receptors. This justifies using I for the imaging of rCBF and doing a delayed scan for the imaging of receptors. The tracer was used for diagnostic purposes in different neurological diseases including epilepsy. A total of 72 patients were investigated; in 56 of them, a SPECT study using a different CBF marker was done within a few days. The SPECT of hypoactive lesions in the various diseases obtained by the initial study with I the delayed study with I and the study with another CBF marker showed no essential differences. So far SPECT studies in various diseases have not furnished any additional information beyond the results obtained with other CBF markers.

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