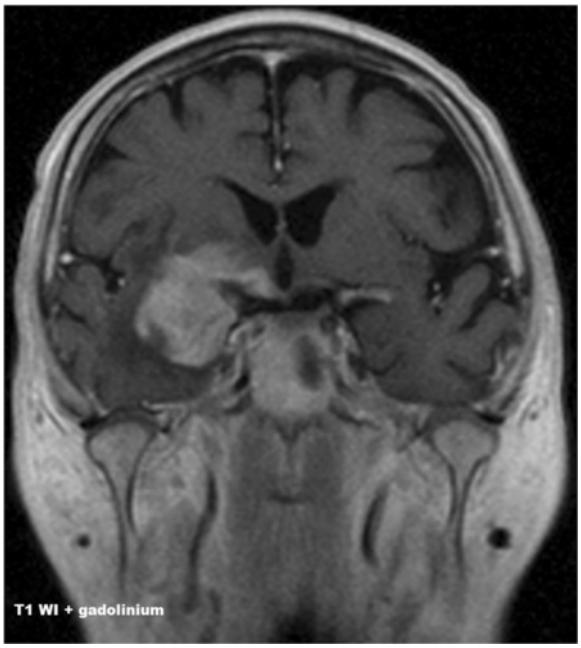

Fig. 3 PCNSL. The involvement of the right optic chiasma

localized infratentorially with nonhomogeneous enhancement (Fig. 7). In the second exceptional case, a non-enhancing supratentorial lesion was present suspected to be low-grade glioma; however, histology confirmed the diagnosis of GBM (WHO Grade IV).

Several significant differences between both brain infiltrative tumors were found (see Table 3). Notably, no homogenous enhancement was found in GBM, in contrast to homogeneous enhancement detected in 64.8% of PCNSL lesions ($p < 0.001$). Enhancement in GBM was nonhomogeneous in 98.1% of cases (no enhancement in 1 case) and necrosis was present in 88.9% of cases. Conversely, necrosis was present only in 5.6% of PCNSL cases and nonhomogeneous enhancement in 14.8% of PCNSL cases (both $p < 0.001$). Diffuse infiltrative type of brain involvement was observed only in PCNSL (24.1% of cases). Additionally, optic pathways infiltration was more frequent in PCNSL than in GBM ($p < 0.001$); present in 42.6% of PCNSL cases and only in 5.6% of GBM cases. Signs of bleeding were more common in GBM (44.4%) than PCNSL (5.6%); $p < 0.001$. Both supratentorial and infratentorial localization was present only in PCNSL (27.7%). The basal ganglia were involved more often in PCNSL (55.6%) than in GBM (18.5%); $p < 0.001$. Finally, cerebral cortex was affected significantly often in GBM (83.3%) than in PCNSL (51.9%); mostly by both enhancing and non-enhancing infiltration. In the Table 4 you can find combinations of several MRI findings and their occurrence in both groups. According those findings we constructed the diagram of the decision tree analysis (Fig. 8). According to Tables 3 and 4, major criteria in decision making process between PCNSL and GBM are the type of enhancement and presence or absence of necrosis. As minor criteria we considered basal ganglia and optic pathways affections, signs of bleeding, both supratentorial and infratentorial localization and diffuse infiltrative type of lesion.

Discussion

In the present study, we compared morphological MRI characteristics in PCNSL and GBM at time of initial MRI. At initial evaluation, PCNSL lesions were presented as multiple infiltrative lesions, which enhanced homogenously or as diffuse infiltrative affection of the brain. GBM typically manifested as a supratentorial solitary infiltrative tumor nearly in all cases nonhomogeneous enhancement was present with evident necrosis. Both GBM and PCNSL lesions reached the surface of the brain in most cases; meningeal and ependymal infiltration was not uncommon.

We detected several significant differences between PCNSL and GBM lesions. The most striking difference was in enhancement patterns; while homogeneous enhancement was not detected in GBM, most PCNSL lesions (64.8%) enhanced homogeneously. Additionally, necrosis was observed in most GBM lesions (88.9%) but was rare in PCNSL (5.6%). Optic pathways infiltration was common in PCNSL and rare in GBM. Other cranial nerves infiltrations were not frequent and were found only in PCNSL (5.6%). Signs of bleeding were rare in PCNSL and common in GBM. The basal ganglia involvement occurred more frequently in PCNSL than in GBM. Diffuse infiltrative type of brain involvement was observed only in PCNSL (24.1%) and also only PCNSL was localized both supratentorial and infratentorial (27.7%). Finally, cerebral cortex was affected significantly often in GBM (83.3%) than in PCNSL (51.9%); mostly by both enhancing and non-enhancing tumorous infiltration. Solitary non-enhancing tumorous affection of cerebral cortex in both diagnoses was uncommon.

Our MRI findings in GBM are in agreement with those reported previously [17]. However, our findings in PCNSL are only partially consistent with those reported by Haldorsen et al. [18]. In the present study, immunocompetent PCNSL patients presented with multiple lesions in 51.9% of cases, and with involvement of the basal ganglia in 55.6% cases. In contrast, Haldorsen et al. reported multiple lesions in only 35% of PCNSL cases, with basal ganglia involvement in 32% of cases [18]. However, they also reported disseminating lesions in 7% of cases [18]. In our study we used category diffused infiltrative affection and probably this category is equal to Haldorsen´s disseminating lesions. We found diffuse infiltrative brain affection by PCNSL in 24.1% of cases.