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Change in CT radiodensity of a colloid cyst of the third ventricle: case report and literature review

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Abstract A unique case is presented of a decrease in density on CT scans of a colloid cyst of the third ventricle with time. This occurred in the absence of any operative intervention in a 35-year-old woman.

Keywords Colloid cyst · CT

Introduction

The radiological appearances of colloid cysts vary [1]. On CT scans, they are typically dense, less commonly isodense with brain and, extremely rarely, hypodense [1–5]. To the best of our knowledge, varying density on CT scans with time in the absence of any operative procedure, has not been reported. We report such a case.

Case report

A 35-year-old woman was admitted with a 3-day history of headache, nausea and meningism. Apart from photophobia and mild nuchal rigidity, there were no neurological signs; in particular, there was no papilloedema, and her Glasgow coma score (GCS) was 15. Apart from polycystic ovaries, her past medical history had been uncomplicated. CT demonstrated a small (8-mm diameter) nonenhancing *dense* lesion in the third ventricle at the level of the foramen of Monro (Fig. 1), with mild obstructive hydrocephalus. Spontaneous resolution of all symptoms occurred within hours of admission, and the patient was discharged home within 72 h. Neurosurgical referral was delayed, and she was initially observed in the general medical outpatient clinic. While the patient was awaiting neurosurgical referral, her symptoms recurred 4 months later, with headache, nausea and vomiting but minimal meningism. Her GCS was 15, and there were no focal neurological signs or papilloedema. CT on this occasion demonstrated that the cyst remained nonenhancing. However, it was now *isodense* with brain and significantly larger, measuring 12 mm in diameter (Fig. 2). Obstructive hydrocephalus was present to an extent similar to that seen at the first presentation. Bilateral external ventricular drains were inserted and, on the following day, a transcortical

Fig. 1 Axial CT scan at first admission. An 8-mm diameter *dense* lesion is present in the third ventricle at the level of the foramen of Monro. Other slices revealed no contrast enhancement and mild obstructive hydrocephalus

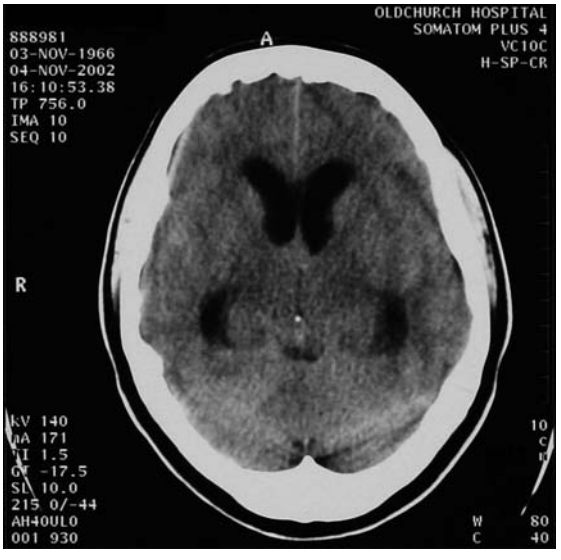

Fig. 2 Contrast-enhanced axial CT scan at second presentation 4 months later. The cyst remains nonenhancing. However, it is now *isodense* and significantly larger (12-mm diameter)

excision of a green-grey, viscid third ventricular cyst was undertaken. Histology later confirmed a typical colloid cyst, without evidence of calcification or xanthogranulomatous change. Following craniotomy, all symptoms resolved, and both drains were later successfully removed. On review 6 weeks later, the patient had resumed all her usual activities and was asymptomatic. MRI was only obtained immediately following ventricular drainage and prior to definitive resection at the second presentation. T1-weighted images showed that, while the centre of the cyst gave high signal, its periphery gave even higher signal, especially posteriorly and inferiorly (Fig. 3a). Furthermore, while T2-weighted images showed its centre to give high, and its rim low, signal (Fig. 3b), a fluid-attenuated inversion recovery image showed that the cyst gave markedly high signal throughout (Fig. 3c). No pathological enhancement was observed following intravenous contrast medium (Fig. 3d).

Discussion

Colloid cysts are rare intracranial lesions, typically restricted to adults, which occur in approximately three individuals per million per year [6]. Their density on CT scans varies [1]. In approximately two thirds of cases, these lesions are homogeneously dense; about one third are homogeneously isodense. In rare cases they may be of low density [1–5]. Typical high density on CT scans has been repeatedly shown not to relate to haemorrhage or calcification [3]. Enhancement is rarely observed, and usually only within the vascular, pericapsular, tissue peripherally [7].

To the best of our knowledge, changing density on CT scans in the absence of any operative procedure has not been reported before. As with CT, colloid cyst appearances on MRI also vary. In contrast to CT, however, the signal is typically heterogeneous [3, 5, 8]. Most cysts give high signal centrally on T1-weighted, but low signal on T2-weighted, images [3–5, 8]. The opposite is typically true of the capsule where, as with CT, the only evidence of contrast enhancement is usually observed. Apart from the centre of the cyst on T1-weighted images, MRI appearances in our case (Fig. 3) were the reverse of those typically observed. Despite the theoretical appeal, typical MRI appearances have been repeatedly shown to not relate to the presence of intracystic paramagnetic substances [3, 8].

Although the principal constituent of colloid cysts is mucin (an intracellular proteinaceous carbohydrate), no study exists in which a serial change in its biochemistry has been correlated with either CT density or MR signal. However, various studies have correlated single static radiological appearances with cholesterol concentration [3, 8] or the protein to water ratio [3, 5, 9]. For example, Maeder et al. [3], in eight patients, found that increased cholesterol concentrations correlated with both high density on CT and high signal on T1-weighted images. Armao et al. [8] reached similar conclusions, based on multiple analyses of a single case. A progressive decrease in effective cholesterol concentration could, therefore, have potentially explained the decreased CT

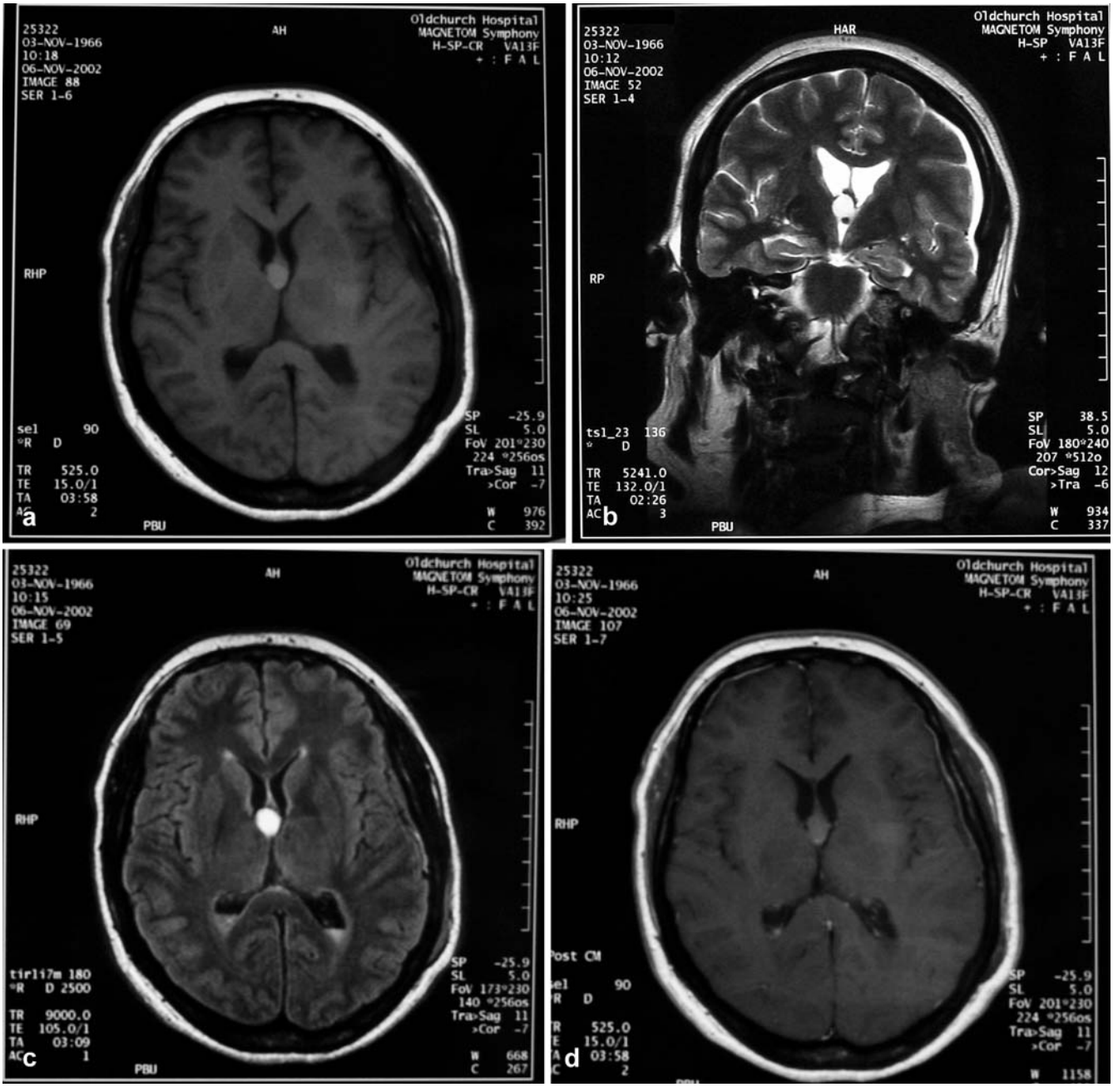

Fig. 3 MRI after shunting and immediately prior to cyst resection. **a** T1-weighted axial image: the cyst centre gives high signal, and the rim more high signal still (especially posteriorly and inferiorly). The ventricular system is now decompressed. **b** T2-weighted coronal image: the cyst centre gives high signal, the rim low signal. A small left subdural collection is also present. **c** Fluid-attenuated inversion recovery axial image: the cyst gives markedly high signal throughout, the left subdural collection is isointense. A moderate amount of intraventricular blood is present postshunting. **d** Contrast-enhanced T1-weighted axial image: no cyst enhancement is seen. Dural enhancement is observed in association with the small subdural collection.

radiodensity observed in our case. Mild high signal on T1-weighted images at second presentation (in comparison to more typical markedly high signal [3–5, 8]) might also support this possibility; unfortunately, no initial MRI was available for comparison. Such potentially decreased cholesterol concentration could have resulted from cyst dilution due to osmotic influx from ventricular cerebrospinal fluid (CSF). This mechanism is supported by the increase in cyst size found at second presentation.

By contrast, Maeder et al. [3] found that low signal on T1-weighted images, along with high signal on T2-weighted images, correlated with increased protein

concentration, a finding compatible with the known predominance of protein in the capsule [3, 4, 8]. While Urso et al. [5] later reported findings in direct conflict with those of Maeder et al. [3], their conclusions were not based on chemical analyses but, rather, by inference from the published literature [5]. In consequence, increased protein concentration could also have explained the imaging characteristics in our case. A deposition of protein would, of course, also be compatible with increased cyst size.

In the only other cases reported of changing appearances, a temporal sequence opposite to that observed in our case was found. In both of these reports, *increased* cyst radiodensity occurred as a direct sequel to ventricular decompression [9, 10]. Because, in one of these reports, relative cyst shrinkage was also demonstrated after shunting, increased density was attributed to increased concentrations of the contents due to presumed cyst dehydration [9]. This reinforces the potential role for osmotic fluxes from CSF in altering cyst radiodensity and size. Notwithstanding, no apparent change in cyst size was demonstrable in the other case of increased density following ventricular decompression [10]. This finding cannot be explained by osmotic fluxes, and an alternative mechanism must be sought.

One other mechanism could be that of rare intracystic haemorrhage [2, 11, 12]. The source of such haemorrhage is usually attributed to the choroid plexus, since this is often intimately attached to colloid cysts [2, 11, 12]. Nevertheless, since colloid cysts occasionally enhance peripherally [7], peripheral vascularization could also provide the source of haemorrhage; as with other benign cystic lesions, such as ganglion cysts. However, in the rare cases where colloid cyst haemorrhages have been reported, clear evidence of blood degradation has usually been obtained on histology; as well as evidence of associated chronic inflammation [2, 9, 11, 12]. None of these appearances were found in our case. Moreover, MRI did not reveal the presence of haemosiderin, which would have been expected at such a late stage following our patient's first presentation.

Finally, xanthogranulomatous change in a colloid cyst could also potentially explain decreased cyst radiodensity. This chronic inflammatory change, typically involving giant cells, is mediated by foamy macrophages and large numbers of haemosiderin-laden macrophages that occasionally replace the entire epithelial lining [13]. Such lesions are typically dense or isodense on CT, isointense or give high signal on T1-weighted images, and give high signal on T2-weighted images: all similar to our case [13]. However, no evidence of xanthogranulomatous change was apparent on histology. Moreover, while many xanthogranulomas enhance solidly [13], no enhancement was seen at either presentation in our case.

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