·Clinical Research·

# Adhesion of cavernous hemangioma in the orbit revealed by CT and MRI: analysis of 97 cases

*Yan-Ming Tian* [1], *Li-Hua Xiao* [2], *Xiao-Wei Gao* [1]

[1]Chinese PLA Eye Center, No. 474 Hospital of Chinese PLA, Urumchi 830012, Xinjiang Uygur Autonomous Region, China
[2]Institute of Orbital Diseases, General Hospital of Armed Police, Beijing100039, China
**Correspondence to:** Yan-Ming Tian. Chinese PLA Eye Center, No. 474 Hospital of Chinese PLA, Urumchi 830012, Xinjiang Uygur Autonomous Region, China. tianyanming@163.com
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## Abstract

• AIM: To assess features of cavernous hemangioma (CH) in the orbit revealed by CT and MRI and summarize prediction of preoperative CT and MRI for the adhesion degree of CH in the orbit.

• METHODS: A total of 97 patients with pathologically confirmed CH in the orbit were examined with axial and coronal CT scan, and axial, coronal, sagittal, and enhanced fat suppression MRI scan. CT and MRI findings and intraoperative adhesion degrees were retrospectively analyzed.

• RESULTS: There were 47 patients with slight adhesion, for whom CT and MRI showed round masses with well defined margins in the extraocular muscles; 14 patients with mild adhesion, for whom CT and MRI revealed irregular masses with unclear boundary between CH and the optic nerve in coronal images, and emissary veins in the posterior region of masses in contrast-enhanced images; 36 patients with severe adhesion, for whom CT and MRI exhibited an irregular or ovoid mass filling the orbital apex, or showed distorted and even spiky margins in the posterior region of masses in contrast enhanced images at the presence of a transparent triangle between the mass and the orbital apex.

• CONCLUSION: Preoperative CT and MRI aid in accurate diagnosis, selection of the surgical approach, and assessment of the adhesion degree and surgical risks for CH.

• KEYWORDS: cavernous hemangioma; computerized tomography; magnetic resonance imaging
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## INTRODUCTION

Cavernous hemangioma (CH) is a common benign lesion in the orbit. CH without or with little adhesion in the orbit can be easily removed, and the adhesion degree of CH in the orbital apex often accounts for the challenge for surgery as well as prognosis. Based on 97 cases of CH in the orbit enrolled in the Center of Orbit Diseases, Armed Police General Hospital and our hospital, the current research analyzed the correlation between clinical and imaging findings to summarize the prediction of imaging examination for the surgical approach for and the prognosis of CH in the orbit.

## MATERIALS AND METHODS

**Subjects** A total of 97 patients with cavernous hemangioma (CH) were recruited from the Center of Orbit Diseases, Armed Police General Hospital and Chinese PLA 474th Hospital hospital from February, 2007 to December, 2008. They included 30 males (30.9%) and 67 females (69.1%), ranging in age from 28-69 years with an average of 44.7 years. The cases consisted of 42 CHs in the right orbit and 55 CHs in the left orbit. The duration between the disease onset and the hospital admission was between 14 days and 20 years.

**Methods** All patients underwent CH removal and pathological diagnosis: 43 with lateral orbitotomy; 31 with transconjunctival approach; and 23 with anterior orbitotomy. All patients were examined with axial and coronal CT scan, and axial, coronal, sagittal, and enhanced fat suppression MRI scan. The adhesion degree of CH in the orbit was classified into three levels for analysis purposes. Mild: no adhesion, mild adhesion, little adhesion, or no severe adhesion; removal of the tumor within 15 minutes after the anterior region of the mass is clipped; no postoperative complications in surgical records; Moderate: moderate adhesion, close adhesion, or difficulty to separate; adhesion and orbitotomy, without obvious complications in surgical records; Severe: lateral orbitotomy; severe or relatively severe adhesion, obvious adhesion, or close adhesion; with postoperative complications in surgical records.

## RESULTS

CT findings: hyperdense masses with well defined margins in the extraocular muscles; CT values: +44 to +65Hu; round or ovoid masses in 36 cases and ovoid in 1 case; with defined location relevant to the optic nerve in 23 cases, respectively superior-medially, medially, laterally, superior-laterally or inferior-laterally to the optic nerve; with a triangle between the mass and the orbital apex in 76 cases and with the mass filling the orbital apex in 21 cases.

MRI findings: gradual intensity increase in dynamic MRI scan for all cases; moderate intensity in T1-weighted images and T2-weighted images; well defined posterior margins of masses and 1-2 emissary veins in 2 cases in contrast enhanced images; masses located superior to the optic nerve and lift up of the middle segment of the optic nerve in one case; uneven and spiky margins in enhanced images in 19 cases; uneven early enhancement and even late enhancement effects, similar to neurilemmoma in one case.

**Intraoperative Adhesion Records** There were 47 patients with slight adhesion, for whom CT and MRI showed round masses with well defined margins in the extraocular muscles; 14 patients with mild adhesion, for whom CT and MRI revealed irregular masses with unclear boundary between CH and the optic nerve in coronal images, and emissary veins in the posterior region of masses in contrast-enhanced images; 36 patients with severe adhesion, for whom CT and MRI exhibited an irregular or ovoid mass filling the orbital apex, or showed distorted and even spiky margins in the posterior region of masses in contrast enhanced images at the presence of a transparent triangle between the mass and the orbital apex. In 21 cases the mass filled the orbital apex, of which 2 showed mild adhesion in the orbit, respectively inferior and lateral to the optic nerve. In one case, the tumor was removed through the conjunctival fornix incision and in the other case, the tumor was removed lateral to the levator palpebrae superioris muscle through the incision below the brown. Orbitotomy was conducted in 19 patients to remove the masses and surgical procedure revealed severe adhesion of the masses in the orbit (Table 1).

**Surgical Approach and Prognosis** In total, 43 patients underwent the procedure through the lateral orbitotomy; 31 through transconjunctival approach; and 23 through the anterior orbitotomy. Proptosis was relieved postoperatively in all patients. In 87 patients, bilateral globe projection was symmetrical at 48 hours post operation. In 7 patients, the globe projection decreased 2-4mm at 48 hours due to local swelling at the affected side, but was symmetrical to that at the intact side at 15 days. In 3 patients, due to tumor compression and fat atrophy in the orbit, the proptosis at the affected side was 2-3cm less than the intact side. 9 patients had better visual acuity; 53 had intact visual acuity; 14 had lower visual acuity but no other complications (recovered within half a month), and 18 had lower visual acuity accompanied by ocular deviation (they did not recover within 1 month, including 4 patients with mydriasis, of whom the pupil recovered at 3 months in 2 patients). Three patients lost eyesight.

**Table 1 The duration of main complaint and adhesion of CH to orbital structures**

| Adhesion degree | Main complaint | | | Total |
|---|---|---|---|---|
| | ≤0.5 years | ≤2 years | >2years | |
| Mild | 27 | 9 | 11 | 47 |
| Moderate | 7 | 5 | 2 | 14 |
| Severe | 14 | 7 | 15 | 36 |
| Total | 48 | 21 | 28 | 97 |

## DISCUSSION

CH is the most common benign orbital lesion that is encapsulated completely. It does not relate to the systemic circulation, and only networks with adjacent tissues through minor vaso vasorum [1].` In most cases, the lesion can be completely removed through exposure and clip of the anterior region, hardly causing any bleeding. As it is relatively easy to remove CH without adhesion in the orbit, ophthalmologists are often not alert. For CH with severe adhesion or filing in the orbital apex, complications such as visual acuity decrease and loss may occur postoperatively. Many patients have good visual acuity or have no discomforts except proptosis, when CH is diagnosed in physical examination. Postoperative visual acuity compromise or ocular deviation potentially leads to medical dispute. Thus preoperative assessment of adhesion of CH to peripheral nerves, blood vessels and muscles is valuable.

Imaging examination often lays a basis for tumor diagnosis. It includes X-ray, ultrasound, CT and MRI. As X-ray is none specific, its value is often compromised for clinical diagnosis. For CH in the orbit, experienced ophthalmologists can conclude a diagnosis via ultrasound [2]. However, ultrasound only reveals basic histology of CH and is inferior to CT and MRI in respects to showing location of lesion and relationship with adjacent structures. Compared with MRI, CT can identify the location, structure, size and number of lesions, but cannot detail the relationship between the lesion and adjacent tissues or the adhesion degree of the lesion to adjacent structures. In the current research, the cases of CH with severe adhesion have the following characteristics.


**Figure 1 Transparent triangle structure (black arrow) revealed by CT between CH and the orbital apex in case 1 with severe adhesion**

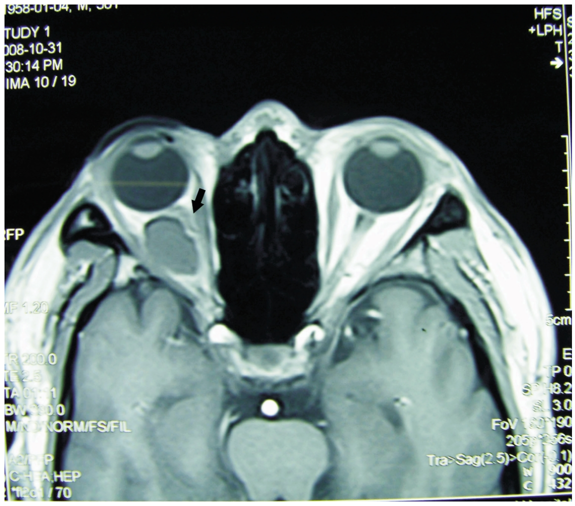


**Figure 2 Distorted and irregular optic nerve (black arrow) revealed by axial MRI in case 1 with severe adhesion**

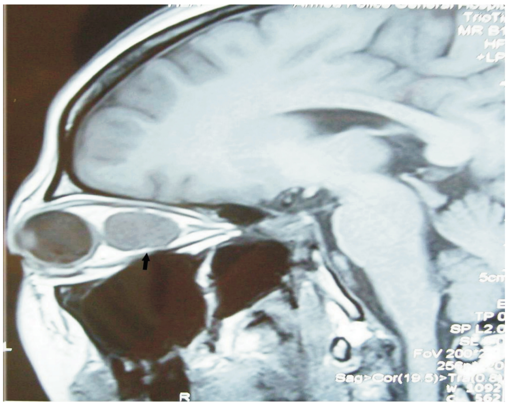

**Figure 3 Distorted optic nerve (black arrow) revealed by sagittal MRI in case 2 with severe adhesion**


**Figure 4 No gap between the optic nerve and CH in different coronal CT images (black arrow) in case 1**

Though CT implied a transparent triangle structure between the tumor and the orbital apex (Figure 1), close adhesion of CH to the orbital structures was observed intraoperatively. Axial MRI images (Figure 2) or sagittal MRI images (Figure 3) showed distorted and irregular optic nerve, and coronal CT (Figure 4) found no gap between the optic nerve and the lesion in different sequences. Intraoperative observations demonstrated that there was close adhesion (laterally and basally) relevant to the distortion of the optic nerve in the orbit. Though the lesion was carefully separated and completely removed, the patients still lost visual acuity in these circumstances. There was controversy over the origins of CH. Most patients were referred to the hospital when they have symptoms. It was thus difficult to predict the disease duration. CH grew gradually and then compressed adjacent structures. The structure of CH decided the compression between CH and adjacent structures. Though CH was incapsulated, there was chance for it to adhere to adjacent tissues when it was compressed, and the morphology of CH changed after compression. Surgical procedure verified the round or ovoid masses without adhesion revealed by CT and MRI. When the lesions were irregular or the margins were spiky or in the angle shape, adhesion possible existed, indicating injuries should be prevented to nerves, muscles, or blood vessels. In the current research, the duration between disease onset and hospital admission was 14 days to 20 years (Table1) and statistical analysis showed no correlation between the duration and adhesion of CH to orbital structures ($\chi^2 = 6.4505$; $P>0.05$). For the lesion that filled the orbital apex, CT revealed the transparent triangle posterior to the tumor and the relative structural relationship between the optic nerve and CH. MRI further identified the relationship among CH and extraocular muscles, blood vessels and the optic nerve. In T1W1-weighted images, CH showed isointense signals to the extraocular muscles, or lower intense signals than the extraocular muscles, while it revealed high intensity signals in T2W1-weighted images. Following injection of contrast agents, small hyperintense dots, where the contrast agents were accumulated, in the lesion represented the conjunction between vasa vasorum and CH. Dynamic MRI can predict the relationship between

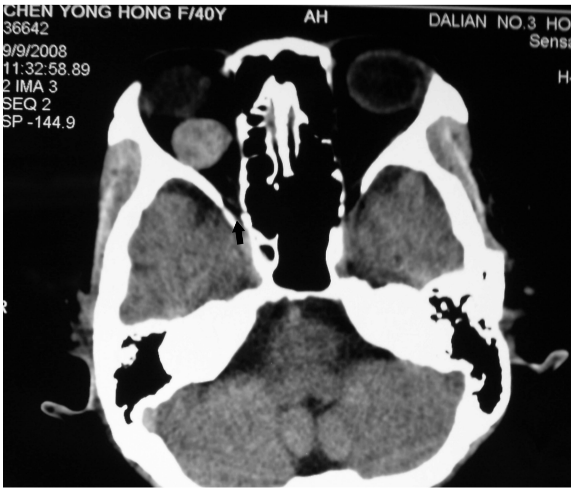


**Figure 5 Transparent triangle structure (black arrow) in the orbital apex in case 3 without adhesion**


**Figure 6 Spiky orbital apex and adjacent structures (black arrow) revealed by sagittal MRI in case 4 with severe adhesion**

nourishing blood vessels and CH[3]. Generally speaking, CH was closely adhered to the orbital apex [4]. If a transparent triangle structure was left in the orbital apex (Figure 5), adhesion was less possible. As the orbital apex is small, if CH primarily originates from this area, it is compressed by structures in the orbital apex in the growth phase. The adhesion of CH in the orbit is thus easily caused. In the

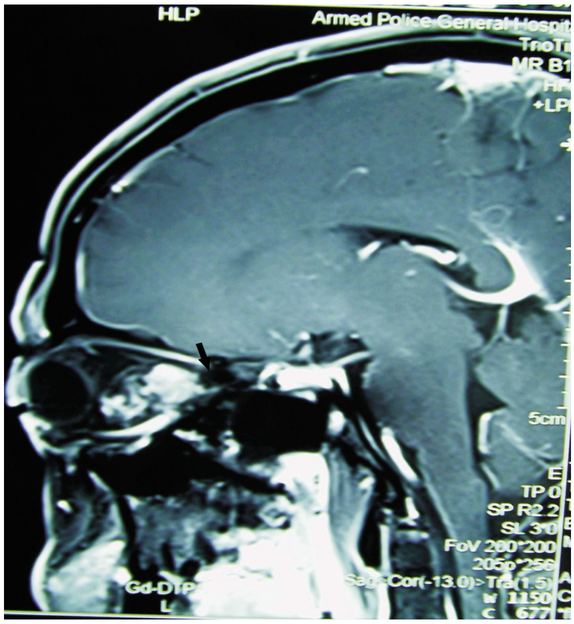


**Figure 7 CT revealed smooth posterior margins of CH in case 4 with severe adhesion**

current research, 21 patients showed filling of CH in the orbit, of them two had mild orbital adhesion. In these two cases, CT and MRI revealed defined margins, no emissary veins, and clear boundary between the optic nerve and CH. CH with the posterior region closely adhered to the orbit was observed intraoperatively, while MRI revealed uneven posterior region, or spiky orbital apex or adjacent structures (Figure 6, 7). Additionally, MRI can predict tumor vascularization, indicating that basal bleeding should be prevented during lesion removal and compression dressing should be monitored in case orbital bleeding would occur.

CT and MRI imaging can complement each other in assessment of adhesion of CH in the orbit. Careful evaluation of imaging findings can predict surgical risks in order to guide safe surgery.

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