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Dural Tail Sign in MR Imaging of Nasopharyngeal Cancer[1]

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Purpose : To describe the dural tail sign in contrast-enhanced MR images of nasopharyngeal carcinoma (NPC).

Materials and Methods : MR images of 19 consecutive patients, in whom three years previously squamous cell type NPC had been pathologically proven, were reviewed for the presence or absence, location and direction of the dural tail sign and the relationship between this sign and the skull base invasion. Histopathologic specimens obtained in two patients were also described.

Results : In ten patients (53%), there was bony invasion of the skull base ; in seven of these (37%), dural tails were found. In seven, this tail extended along the floor of the middle cranial fossa ; in 5, along the petro-clivus, and in 4, along the tentorium. In all these cases, the adjacent skull base was involved. Histopathologic examination in two patients with dural tails in the middle cranial fossa revealed fibrosis and hypervascularity of the dura mater without evidence of tumor cell infiltration.

Conclusion : The dural tail sign appears to be not infrequent in patients with advanced NPC. The dural tail may be a good indicator of intracranial tumor spread.

Index Words : Nasopharynx, neoplasms
Meninges, MR

The dural tail sign was first described by Wilms (1), thickening of the dura in continuity with convexity meningiomas as seen on contrast-enhanced MRI. Tokumaru and associates (2) stated that dural tails consisted of histopathologically loose connective tissue, and showed hypervascularity and vascular dilatation. They could be found not only in meningioma, but also in meningioma, but also in various pathologies such as acoustic schwannoma (3), meningeal metastasis (4), adenoid cystic carcinoma (5), cerebral gumma (6), aggressive papillary middle-ear tumor (6), superficial glioma (7) and pituitary apoplexy (8). To our knowledge, no report has described the presence of the dural tail sign in nasopharyngeal carcinomas (NPC).

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We report here the dural tails associated with NPC and evaluate the relationship between the dural tail and skull base invasion. In addition, we describe the histopathology of the dura mater in two NPC patients.

Materials and Methods

During three-year period, 19 consecutive patients (men : 16, women : 3, mean age : 40 yrs) with NPC underwent MR examination on a 1.5T or 1.0T superconductive MR scanner. In all 19, the presence of squamous cell carcinoma had been proven by either direct punch biopsy or aspiration biopsy of cervical nodes. Axial T1-weighted (TR : 500-700msec, TE : 15-20msec) and T2-weighted spin echo images (TR : 2300-2500msec, TE : 80-90msec), as well as Gd-DTPA (0.1mmol/kg body weight) enhanced axial, coronal, and sagittal T1-weighted images were obtained. MR images of all patients were reviewed for the presence or absence, location and direction of the dural tail

sign and the relationship between this sign and skull base invasion. We adopted Goldshers criteria(9) for the definition of a dural tail : (a) its presence on at least two consecutive sections through the tumor at the same site in more than one plane ; (b) greatest thickness adjacent to the tumor and tapering away from it ; and (c) enhancement greater than that of the tumor itself. According to their direction and location, dural tails was classified as lateral, posterior lateral (petroclival) or tentorially extended. In addition, two patients with laterally-extended dural tails underwent biopsy at the site of tail.

Results

On MRI, ten patients (53%) showed bony invasion of the clivus which were shown on MRI. Seven of these, all men (mean age : 52 yrs) showed the dural tail adjacent to the skull base, which had been invaded by NPC. The tails were located laterally in seven (Fig. 1), petroclival in five (Fig. 2), and tentorial in four (Fig. 3). Three patients with dural tails along the floor of the middle cranial fossa showed encasement of the internal carotid artery. One patient showed downward exten-

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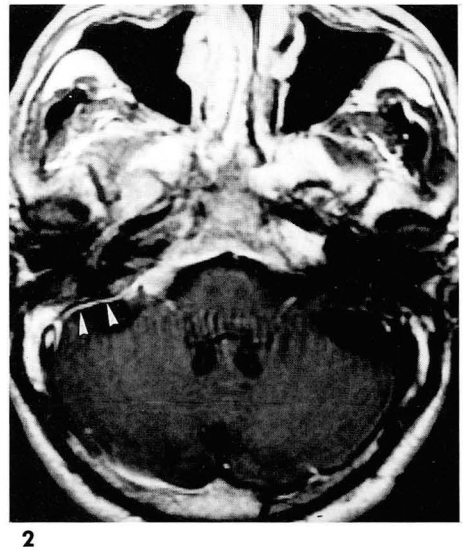

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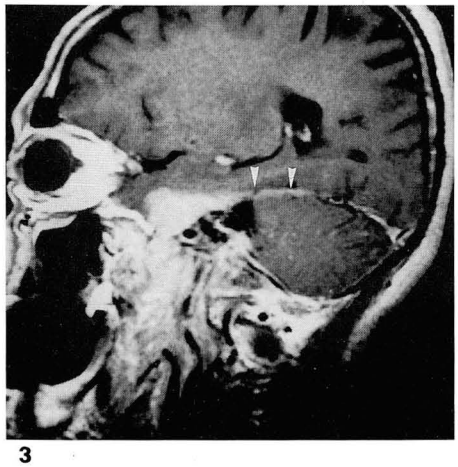
Fig. 1. Lateral extension of the dural tail. Enhanced T1-weighted MR image demonstrates the dural tail (white arrow) along the floor of the right middle cranial fossa and intracranial tumor invasion through the foramen ovale (black arrow).

Fig. 2. Petroclival extension of the dural tail. Enhanced T1-weighted MR image demonstrates the dural tail along the ridge of the right petroclivus (arrow heads).



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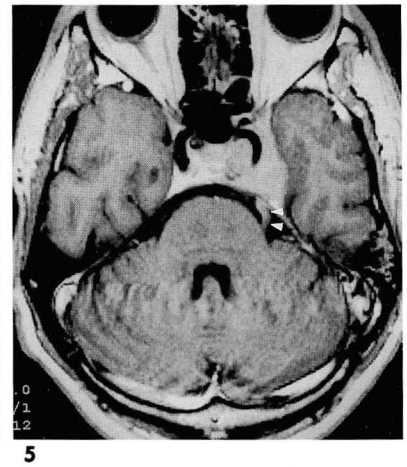

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Fig. 3. Tentorial extension of the dural tail. Enhanced T1-weighted MR image in the sagittal plane demonstrates the dural tail (arrow heads) along the tentorium which extends from the cavernous sinus involved by the tumor.

Fig. 4. Downward extension of the dural tail. Enhanced T1-weighted MR image demonstrates the dural tail (arrows) going down along the posterior margin of the clivus.

Fig. 5. Enhanced T1-weighted MR image demonstrates the dural tail along the course of the left trigeminal nerve (arrow heads). The dural tail is also seen in the ridge of the left tentorium which extends from the left cavernous sinus invaded by the tumor. Note the encasement of the left internal carotid artery.

sion of the dural tail along the upper cervical vertebrae from the retroclival tumor (Fig. 4),and one patient showed perineural extension along the trigeminal nerve (Fig. 5) from the involved petroclivus.

Histopathologic examination in two patients with dural tails on the middle cranial fossa showed fibrosis and hypervascularity of the dura mater, but no evidence of tumor cell infiltration. Biopsy fragments were obtained at a point 15-20 mm lateral to the foramen ovale.

Discussion

The pathology of dural tails has been much discussed. Goldsher et al (9) stated that they were tumor nodules of meningiomas. Tokumaru (2), on the other hand, postulated that dural tail extending more than 1mm from the tumor margin revealed reactive change but not the presence of tumor cells. The tail was thus thought to be caused by either direct tumor invasion or reactive changes of connective tissue and vessels adjacent to the dura-based tumor. We postulate that in nasopharyngeal carcinomas, the dural tails are caused by both actual tumor invasion and reactive changes. We suggest that the further they are located from the central skull base, the cavernous sinus or the clivus, the less the possibility of actual tumor invasion.

Based on the CT findings, the frequency of skull base erosion in NPC is reported to be 12.2% (11), but on the basis of MR findings, the frequency is 31 % (12). This difference may be explained by the better contrast resolution of MRI. In our patients, the disease was more advanced stage, and our results thus revealed a higher frequency (52.6%).

In this study, the dural tails appeared not infrequently in NPC cases. In all such patients with these tails, the carcinoma had invaded the base of the skull. NPC usually arises in the lateral pharyngeal recess, and can invade in all directions (13); it can invade superiorly into the cranial cavity through several anatomic routes including either bony apertures of the petroclinoid fissure, foramen lacerum, foramen ovale, carotid canal or jugular fossa, or by direct bony invasion (12-15). In this study, histopatholgic findings agreed with those of a previous report (2) which claimed that the tails indicated not tumor spread along the meninges but congestion of the venous plexus along the greater wing of the sphenoid bone, clivus or tentorium cerebelli. In our patiens, the most common direction of tumor invasion was lateral, since the site at which NPC most frequently arises is the lateral pharyngeal recess (14-16), followed by the petro-clival extension. Anterior extension, which progresses through the pterygopalatine fossa and the inferior orbital fissure into the orbit occurs rarely.

It has been reported that about 80% of NPC are of the squamous cell type(1), in which the tumor causes perineural extension, as is seen in adenoid cystic carcinoma (17); in this series, one patient showed perineural tumor extension along the trigeminal nerve. To detect the subtle infiltrations of small lesion of the nasopharynx, Vogl and associates (18) recommended the use of contrast-enhanced MRI; we also believe that to define the extent of NPC, this is indispensable.

To determine whether or not NPC invades the bony skull base is important for the tumor staging or planning radiation therapy. The presence of the dural tail indicates a high probability of intracranial invasion. Skull base invasion and perineural involvement alter radiation ports and upgrade the tumor stage to T4.

In conclusion, the dural tail sign is not infrequently seen in patients at an advanced stage of NPC and appears to be a reliable indicator of skull base invasion.

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비인두암의 MR영상에서의 경막꼬리징후[1]

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목 적 : 비인두암의 조영증강 MR영상에서 나타나는 경막꼬리징후를 기술하고자 한다.

대상 및 방법 : 3년동안 비인두암으로 MRI를 시행한 총 19명을 대상으로 하였다. 환자들 모두 상피세포암으로 확진되었다. MR영상은 경막꼬리징후의 유무, 위치와 진행방향 과 경막꼬리와 두개기저부 침범과의 관계 등을 중점으로 후향적으로 분석하였다. 경막꼬리징후가 중두개와에 위치하는 두명의 환자에서 경막꼬리의 생검을 시도하였다.

결 과 : 10명(53%)의 환자에서 두개기저부의 침범이 있었고 이중 7명에서 경막꼬리가 동반되었다. 이들 경막 꼬리는 중두개와에서 7예, 추체-사대에서5예, 천막에서 4예가 관찰되었다. 이들 전예에서 경막꼬리에 인접한 두개기저부의 침범이 함께 관찰되었다. 두명에서 시행한 경막꼬리의 생검에서 섬유화 및 혈관의 증식이 보였고 종양세포의 침윤은 없었다.

결 론 : 진행된 비인두암 환자에서 나타나는 경막꼬리징후는 드물지 않고 이것의 존재는 종양의 두개내침범을 시사한다.