MRI of Intraspinal Cysticercosis

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Purpose: To describe the MR features of intraspinal cysticercosis.

Materials and Methods: Medical records and MR images of four cases of intraspinal cysticercosis were retrospectively reviewed. The MR findings were described with regard to the location and signal intensity of the lesions, contrast enhancement, presence or absence of associated intracranial cysticerci, and other findings.

Results: There were three cases of subarachnoidal form and one case of intramedullary form. Cysticerci of subarachnoidal form in three cases were located in retromediullary space at C2 level, anterior to cord at C1-C6 levels, and lumbosacral area, respectively. The signal intensities of the lesions were same as those of CSF. Localized arachnoidal enhancement was found in all three cases. In one case there was a large area of high signal intensity within the spinal cord on T2-weighted image suggesting either ischemia secondary to vascular compromise or inflammatory edema. All of these three cases accompanied intracranial cysticercosis. Intramedullary cysticercosis in one case was shown as a single 1 cm cystic lesion at C2 level, which showed hypointense signal on T1-weighted image, hyperintense signal on T2-weighted image, and signet-ring-like enhancement. This lesion did not accompany intracranial cysticerci.

Conclusion: Intraspinal cysticercosis manifested as single or multiple cysts within either spinal cord or subarachnoid space, and were frequently associated with arachnoiditis.

Index Words: Spinal canal, MR
Spinal cord, infection
Parasites

INTRODUCTION

Intraspinal cysticercosis is extremely rare. There are two forms, intramedullary and subarachnoid. Patients with intraspinal cysticercosis usually present with nonspecific symptoms and signs including abnormalities of sensation, motor or reflex.

There has been only a few reports on MR imaging of intraspinal cysticercosis (1-4). We describe MR imaging findings of spinal cysticercosis in four cases.

MATERIALS and METHODS

Four patients aged from 26 to 63 years (all males) with intraspinal cysticercosis were examined with MR imaging. The diagnosis was proved at surgery and pathologic examination in three cases, while in the remaining one it was established by the combination of the imaging findings and positive serologic tests, enzyme-linked immunosorbent assay (ELISA) for cysticercosis-specific immunoglobulin G (IgG) antibody. MR images were obtained on a 2.0 T (case 1, 4), 0.35 T (case 2), or 0.5 T (case 3) units. All patients had non-enhanced sagittal T1-weighted, axial proton-density-weighted, and T2-weighted or T2*-weighted images. Contrast-enhanced T1-weighted images were obtained after intravenous injection of gadopentetate dimeglumine (0.1 mmol/Kg, Magnevist, Shering, Germany) in all patients.
MR findings were reviewed regarding to the location and signal intensity of the cysts, presence and pattern of contrast enhancement, and presence or absence of associated intracranial cysticerci.

**CASE PRESENTATIONS**

**Case 1**
A 40-year-old man had history of right postauricular pain and upper extremity weakness for 6 months. There were no other neurologic deficits. On MR imaging of cervical spine there was a 1 cm round cyst within the spinal cord at C2 level. On T1-weighted image the lesion showed CSF-like low signal intensity with a small focal iso-signal intensity. On T2*-weighted axial image the cystic content of high signal intensity was outlined by rim of low signal intensity. On postcontrast T1-weighted image signet-ringlike rim enhancement was found (Fig. 1). There were no abnormalities on the brain MR imaging. A total laminectomy was performed at C2-C3 level. After myelotomy a like lesion surrounded by gliotic wall was found. Pathologically the lesion proved to be degenerated cysticercus with grayish necrotic debris.

**Case 2**
A 63-year-old man was presented with low back pain of 8-month history. The symptom aggravated one week prior to admission. On admission he also complained of headache and tremor of right hand. On neurologic examination paresthesia of both lower extremities, weakness of right toes, and decreased deep tendon reflex were detected. Contrast-enhanced T1-weighted sagittal MR image of lumbar spine showed multiple round cysts of low signal intensity with septum-like enhancement of intervening walls from the level of L1 to L5-S1. The lesions showed high signal intensity on T2-weighted images. Cauda equinae were not identifiable, being probably compressed by the multiple cystic lesions (Fig. 2a). On brain MR imaging there were multiple cystic lesions in the base of frontal lobes, suprasellar and perimesencephalic cisterns, and posterior fossa indicating typical parenchymal and cisternal neurocysticercosis (Fig. 2b). At surgery of lumbar spine, multiple fluid-filled yellowish colored cystic lesions were seen to occupy the thecal sac, which proved to be degenerated cysticerci at microscopic examination.

**Case 3**
A 40-year-old man was admitted because of weakness of left upper extremity, diplopia and tingling sensation of extremities for 6 months. Two years prior to admission he had suffered from nausea and vomiting, and brain MR imaging had shown multiple cystic lesions in the suprasellar and sylvian cisterns suggesting meningeal cysticercosis and communicating hydrocephalus. Cervical spinal MR imaging had shown cystic lesions at the level of the cervicomedullary junction and medulla oblongata. He was diagnosed as neurocysticercosis, and treated with praziquantel. On follow-up MR imaging of cervical spine at admission there was a 0.76 × 1.5 cm ovoid cyst in the subarachnoid space posterior to spinal cord at the level of C2 (Fig. 3). The cyst showed low intensity on T1-weighted image and high intensity on T2-weighted image. On postcontrast T1-weighted image localized enhancement was seen on the surface of slightly enlarged spinal cord. There was also a large area of high signal intensity within the cervical cord on

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*Fig. 1. Case 1*
a. T1-weighted (500/30) sagittal image of cervical spine shows a 1 cm round cyst of low signal intensity within spinal cord at C2 level (arrow).
b. Postcontrast T1-weighted (500/30) sagittal image of cervical spine shows signet-ring enhancement of the lesion (arrow). At surgery, a degenerated cysticercus was removed.*
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Fig. 2. Case 2
a. Postcontrast T1-weighted (500/30) sagittal image of lumbar spine shows multiple cystic lesions (black arrows) with focal enhancement of multisepated appearance (white arrows) occupying entire lumbar dural sac.
b. On T1-weighted (500/30) sagittal image of brain there are multiple cystic lesions in right frontal lobe (arrowhead) and basal cisterns of posterior fossa (arrows) indicating cysticercosis. At surgery of lumbar spine multiple degenerated cysticerci were recovered.

Fig. 3. Case 3
a. On postcontrast T1-weighted (500/30) sagittal image of cervical spine there is a 0.7 × 1.5 cm ovoid lesion of low signal intensity (arrow) in area of posterior portion of spinal cord at C2 level. There are multifocal areas of enhancement on the surface of spinal cord and inferior portion of the lesion (arrowheads).
b. T2-weighted (2500/90) sagittal image of cervical spine shows diffuse area of high signal intensity within the entire cervical cord (arrows) suggesting edema secondary to inflammation of cervical cord and/or ischemia/fat necrosis caused by compromise of anterior spinal artery secondary to cysticercal arachnoiditis.
c. On postcontrast T1-weighted (500/30) axial image of brain there are multiple cystic lesions associated with cisternal enhancement (arrows) indicating cysticercal meningitis.

T2-weighted image. Partial laminectomy of C1 and total laminectomy of C2 was performed. At surgery they found a retromedullary cyst in subarachnoid space with severe adhesion to the surface of spinal cord, aspirated 3 ml of grayish brown colored fluid from the cyst, and partially removed the cyst wall. Microscopic examination of the cyst wall showed some inflammatory findings suggestive of degenerated cysticercus.

Case 4
A 26-year-old man presented with nausea, vomiting, and headache. Two years ago he had been diagnosed as neurocysticercosis on the basis of typical brain MR findings of cysticercosis and positive ELISA test for cysticercus. During the follow-up with praziquantel therapy, nausea and vomiting was aggravated, and tingling sensation of both hands newly developed. Neurologic examination revealed hypesthesia of T2–T12.
dermatome. MR imaging of cervical spine showed an elongated cystlike lesion in the subarachnoid space anterior to the spinal cord at C1-C6 levels, signal intensity of which was low on T1-weighted image and high on T2-weighted image. The spinal cord was compressed by the mass. On contrast-enhanced T1-weighted image linear enhancement on the anterior surface of the spinal cord was found (Fig. 4a). On brain MR imaging there were multiple cystic lesions with partial rim enhancement in the suprasellar cistern, right sylvian fissure (Fig. 4b) and fourth ventricle, indicating cysticercosis with meningitis. The patient has been followed-up with praziquantel treatment with slight improvement of clinical symptoms.

**DISCUSSION**

Although the radiologic findings of intracranial cysticercosis have been well described (2-12), those of intraspinal cysticercosis have seldom been reported (1-4, 13), because it is an extremely rare form of neurocysticercosis. In a study, only one cysticercus out of 106 cysticerci in 50 patients was found in spinal subarachnoid space (4). In another study by Carbajal et al (8) no spinal cysticercosis was found among 232 surgically confirmed neurocysticercosis.

Intraspinal cysticercosis involves the subarachnoid space and, less often, the cord or epidural space (1). The mode of transmission of cysticerci to the spinal canal is by either hematogenous spread or dissemination through CSF space (1, 13). In the present study, three patients with subarachnoidal cysticercosis had intracranial cysticerci: cisternal (case 2-4), ventricular (case 3), or parenchymal lesions (case 2), whereas one patient with intramedullary cysticercosis (case 1) did not have intracranial lesions. As suggested in our cases, the intradural-extradural cysticercosis is likely to be caused by dissemination through CSF space, while intramedullary cysticercosis may result from hematogenous spread.

The MR findings of cysticercosis are variable and depend fundamentally on four factors: stages in evolution, location, size, and number. Viable cysticerci do not cause inflammation, appear as round cysts with mural nodule (scolex) and usually show neither enhancement nor edema on MR imaging. At this stage the cystic fluid appears isointense to CSF. After some months to years, as the cysticerci begin to degenerate, an acute inflammatory stage may ensue from humoral and tissue response to cysticerci, causing surrounding edema and enhancement on MR imaging. Case 1, intramedullary form of cysticercosis in the present study, corresponded to this stage which was confirmed pathologically. Spinal subarachnoid cysticercosis presents either as an intradural-extradural cyst or as an arachnoiditis (4), for which racemose cysticercus is presumably more responsible than cysticercus cellulosae. The racemose cysticercus is an anomalous, multiloculated form with proliferating bladder wall and lacking a scolex. These cysticerci are usually located in the ventricles and basal cisterns. The racemose cysticercus within the cisterns may manifest as a large space-occupying lesion of CSF intensity, causing obstruction or compression of the adjacent structures. It frequently incites an extensive leptomeningeal inflammation causing fibrotic thickening of the surrounding tissue. Chronic granulomatous meningitis around the basal cisterns results in communicating hydrocephalus, and proliferative endarteritis may cause infarction (2). Three patients of subarachnoid form in the present series (case 2-4) all showed leptomeningeal enhancement on postcontrast MR imaging. Surgery confirmed severe inflammatory adhesion in case 2 and 3. Diffuse area of high signal intensity within the entire cervical cord seen on T2-weighted images of case 3 presumably represents either edema secondary to inflam-

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**Fig. 4.** Case 4  
a. Postcontrast T1-weighted (400/30) sagittal image of cervical spine shows a tubular cystic lesion of low signal intensity (arrows) anterior to spinal cord at C1-C6 levels compressing the cord posteriorly. There is linear enhancement on the anterior surface of spinal cord (arrowheads). The cystic lesion presumably represents either racemose cysticercus or arachnoid cyst secondary to cysticercal arachnoiditis.  
b. Postcontrast T1-weighted (600/30) axial image of brain shows multiple conglomerated cystic lesions with subtle rim enhancement in right sylvian fissure, suggesting cysticerci of racemose type (arrows).
mation of the spinal cord or ischemia/infarction caused by compromise of anterior spinal artery secondary to cysterceral arachnoiditis (Fig. 3b). The cyst anterior to the spinal cord, as seen in case 4, might reflect either the racemose type of cystercus lack of scolex or arachnoid cyst secondary to adhesive cysterceral arachnoiditis.

In conclusion, intraspinal cysticercosis manifested as single or multiple cysts in the subarachnoid space associated with arachnoiditis and less often, as a solitary cyst with wall enhancement. Contrast enhanced MR imaging appears indispensable in the evaluation of patients suspected of having arachnoiditis or an intramedullary lesion with inflammation in intraspinal cysticercosis.

REFERENCES


척추강내 유미낭충증의 자기공명영상

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김승철 · 장기현 · 한문희 · 한기석 · 황희영

목 적: 척추강내 유미낭충증의 자기공명영상 소견을 기술하고자 한다.

대상 및 방법: 척추강내 유미낭충증으로 진단된 4예의 임상 경과와 자기공명영상 소견을 후향적으로 분석하였다. 자기공명영상 소견은 병변의 위치, 신호 강도, 조영증강, 두개강내 유미낭충증의 유무 및 기타 소견을 분석하였다.

결 과: 병변들은 지주막하형이 3예, 척수내형이 1예 있었다. 지주막하형의 위치는 각각 제2 경추의 척수 후방, 제1-6경추의 척수 전방 및 요전추 부위였다. 지주막하 병변의 신호 강도는 뇌척수액의 그것과 같았고, 지주막의 국소적 조영증강이 3예 모두에서 있었다. 한 예는 T2 강조영상에서 척수내에 미만성의 고신호강도를 보여 혈관 압박 등에 의한 허혈성 변화이거나 혹은 염증성 부종으로 생각되었다. 이들 3예 모두 두개강내 유미낭충증을 동반하고 있었다. 한 예의 척수내 유미낭충증은 제 2경추 척수내에 1cm 크기의 낭성 병변이었다. 이 병변은 T1 강조 영상에서 저신호강도를 보였으며 병변의 주위 조영증강을 보였다. 이 병변은 두개강내 유미낭충증을 동반하지 않았다.

결 론: 척추강내 유미낭충증은 지주막하 혹은 척수내에 단발 혹은 다발성의 낭성 병변을 동반하며 지주막하염과 혼히 동반된다.
연세의대 진단방사선과 연수강좌

일시: 1995년 4월 2일(일요일) 오전 9:00~오후 5:00
장소: 연세대학교 의과대학 강당
연수평점: 6점
수강안내:
- 신청방법: 1) 사전등록 - 전화: 361-5837(Fax: 393-3035)
  2) 연수교육 당일 현장등록(08:30-09:00)
- 수강료:
  1) 전문의 및 일반의: ₩40,000(당일등록: ₩50,000)
  2) 전공의: ₩25,000(당일등록: ₩30,000)
  3) 사전등록은 3월 31일(금)까지 송금 완료된 경우만 인정
  <한일은행 연세지점 279-041761-02-001 (김병진)>

Radiology of infectious Lung Disease

< 오전 >
08:30-09:00 등록
09:00-09:10 안내
09:10-09:40 Clinical Overview of Infectious Lung disease
09:40-10:20 Pathology of Infectious Lung Disease
10:20-10:50 Bacterial pneumonia-imaging diagnosis
10:50-11:10 Coffee Break
11:10-11:40 Fungal & parasitic lung disease
11:40-12:10 Infection in immunocompromised patients & hospital infection
12:10-13:10 Lunch

< 오후 >
13:10-13:40 Thoracic tuberculosis-pathology
13:40-14:10 Imaging of pulmonary tuberculosis
14:10-14:40 Imaging of thoracic extrapulmonary tuberculosis
14:40-15:00 Coffee Break
15:00-15:30 Viral, Rickettsia & other infectious lung disease
15:30-16:00 Pediatric infectious lung disease
16:00-17:00 질문 및 토의