Sequential Metrizamide Computed Tomographic Myelography in Syringohydromyelia

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脊髄空洞症における経時的 Metrizamide CT Myelograpny

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脊髄空洞症の診断において Metrizamide CT Myelography (MCTM) の有用性が報告されている．しかし外科的治療と関連して MCTM を検討した報告は見当たらない．我々は臨床的に脊髄空洞症と診断された 3 例に経時的に MCTM を行ない Metrizamide の動態を観察した．その結果 3 例中 2 例で 3 時間後，6 時間後（1 例のみ），および 24時間後のスキャンにおいて脊髄空洞内への Metrizamide の流入が認められた．このうち 1 例では手術 (syringo-subarachnoid shunt) を行なうことにより臨床症状の軽減をみた．Metrizamide 注入後経時的にスキャンし，クモ膜下腔と脊髄空洞との Metrizamide の動態を解析することにより，脊髄空洞症の外科的治療に関して適応の判定および術式の選択に役立つ可能性があると思われた．

Computed tomography (CT) provides valuable information of bony structures of the spine, but has been disappointing in obtaining an accurate information of the intraspinal structure without contrast media except in the upper cervical region. With intrathecal enhancement by metrizamide, however, CT images well the structure of the subarachonid space (SAS) and the spinal cord[1-3].

High resolution CT can demonstrate the central cavity in the cervical region without intravenous or intrathecal administration of contrast media[4]. In some cases of syringohydromyelia (SHM), the syrinx has been opacified by contrast media[2)3)]. In syringohydromyelia cases, metrizamide may enter the syrinx cavity commensurate with the rate of CSF flow from the subarachnoid space. CT is approximately 100 times more sensitive than conventional radiographic systems in resolving differences in X-ray attenuation

coefficients[5], thus small amounts of contrast media may be imaged when they enter the syrinx.

We report the CSF dynamics examined by metrizamide CT myelography (MCTM) in three patients with SHM, and discuss a value of the examination for determining a diagnosis and surgical indication of SHM.

Materials and Methods

Three patients with clinically suspected SHM were examined with sequential MCTM following conventional metrizamide myelography (MM).

Metrizamide with 170-210mg iodine per ml was used, and was instilled into the subarachnoid space via lumbar puncture. After evaluating the size and shape of the spinal cord by MM, MCTM was performed at 1,3, and 24 hours post-instillation in all cases. In one case examination at 6 hours post-instillation was added. The CT scanner was an AS&E 450, and sections were of 5 or 10mm thicknesses.

The attenuation values of the spinal cord in the cervical and/or thoracic regions and of the subarachnoid space (SAS) at the foramen magnum or upper cervical regions were ascertained.

Case Reports

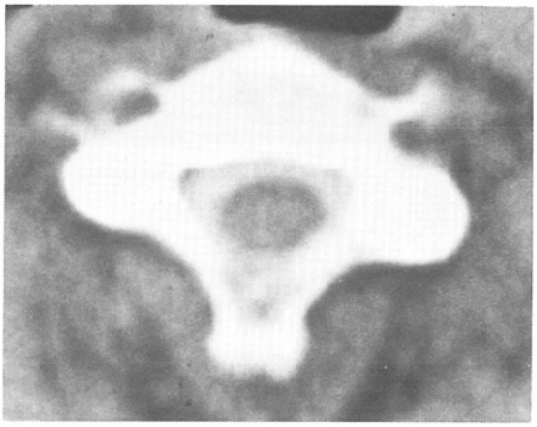
Case 1. This 27 year-old male with von Recklinghausen's disease had had weakness of his right upper and lower extremities for five years. Neurological examination disclosed horizontal nystagmus, moderate muscle atrophy of the upper limbs more on the right, loss of biceps reflex on both sides, increased deep tendon reflexes in the lower limbs, Babinski sign on the right, and hypalgesia in the right upper limb, right thoracal region and left lower limb. Skull and cervical radiography revealed basilar impression and assimilation of the atlas. Oil myelography showed a widened cervical cord and caudad herniation of the cerebellar tonsils, indicating a Chiari 1 malformation. MCTM was performed in order to visualize the syrinx. Thirteen ml metrizamide (210mgI/ml) were introduced intrathecally by lumbar puncture. At one hour, the spinal cord was widened in the cervical and upper thoracic regions, and there was no inflow of metrizamide into the syrinx (Fig. 1A). Three hours post-instillation, the attenuation value centrally in the cervical portion of the cord rose to 76 H.U., indicating an inflow of metrizamide. Though metrizamide in the SAS was completely diluted at twenty-four hours, the attenuation value of the syrinx was 108 H.U.-higher than what it was at three hours (Fig. 2.). The length of the syrinx was clearly demonstrated in reconstructed sagittal sections (Fig. 1D). This case was explored at the cervico-thoracic region, and a syringo-subarachnoid shunt was established. This procedure was adapted because metrizamide inflow was delayed, and metrizamide was obviously trapped at twenty-four hours. After surgery, there occurred mild to moderate resolution of the weakness of the right upper extremity and the paresthesia of the left lower extremity. The syrinx was found to be decreased in size on postsurgery MCTM (Fig. 1E).

Case 2. This 46 year-old female experienced pain in the left shoulder and upper extremity six years previously which thereafter had localized in the region of left elbow. During the subsequent five years, she experienced loss of thermal sensation in the left upper extremity and repeated burns and trauma in those regions. Neurological examination revealed hypalgesia and thermal hypesthesia in the left upper limb and upper chest (C4-T6), and decreased deep thendon reflexes in the left upper limb. Clinical signs suggested a syringomyelic lesion deviated to the left in the cervical cord. Metrizamide myelography (170mgI/ml, 10ml) showed no difinite widening of the cervical portion of the spinal cord. With MCTM at one hour, although the attenuation value of the SAS was 260 H.U., there was no inflow of metrizamide into a syrinx (Fig. 3A). At 3 hours there was definite inflow of metrizamide into a syrinx in the cervical cord and the attenuation value of the syrinx had risen to 110 H.U. at six hours, nearly the same as that of the SAS (Fig. 3B, 3C, 4). At twenty-four hours, there appeared to be persistence of metrizamide within the syrinx, although metrizamide in the SAS had completely dissipated (Fig. 3D).

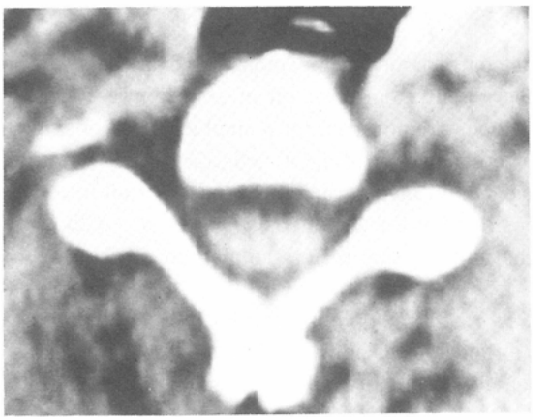
Case 3. This 30 year-old female had a 19 year history of weakness of the right upper extremity, and experienced diminished pain and thermal sensitivity of the right hand since the age of 14 years. At 18

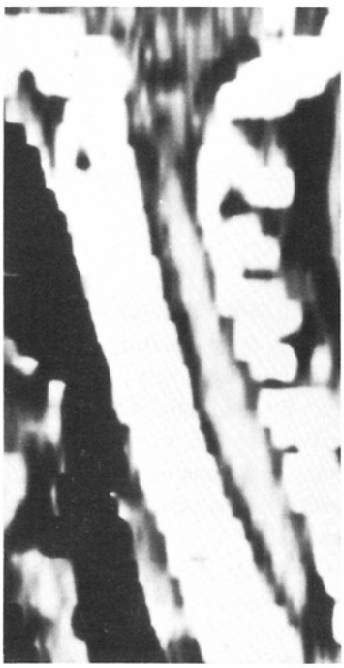
years of age, she had dissociated sensory loss involving the left side of her face and her right upper extremity. Skull and cervical radiography revealed platybasia and assimilation of the atlas and axis. Metrizamide myelography (210mgI/ml, 8ml) intrathecally revealed marked swelling of the cervical cord but no caudad herniation of the cerebellar tonsils. Slight inflow of metrizamide was suspected at one hour by MCTM. However, there was no definite rise in the attenuation value of the syrinx by three or twenty-four hours (Fig. 5). The diagnosis of SHM was regarded definite according to typical neurological symptoms, though there was questionable evidence of inflow of metrizamide into the syrinx.

A. At one hour, there is no evidence of inflow of metrizamide within the expanded cord.

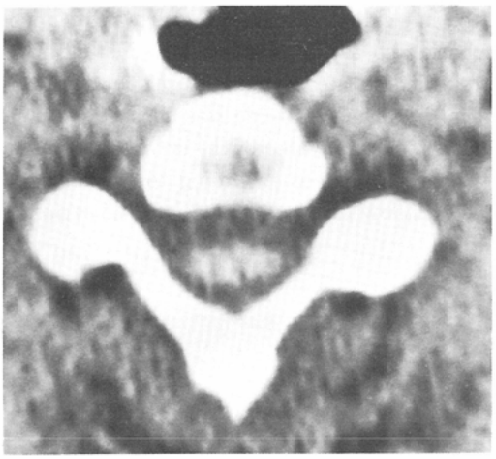


B. At three hours, inflow of metrizamide into the syrinx is evident.





C.D. At twenty-four hours. The syrinx is clearly seen since metrizamide in the subarachnoid space is completely diluted. Reconstructed sagittal section (D).



E. Twenty-four hours MCTM, postsurgery, shows reduction of the syrinx size.

Fig. 1　Sequential metrizamide CT myelography. Case 1.

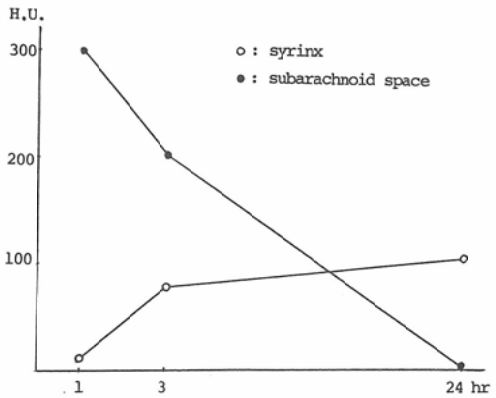


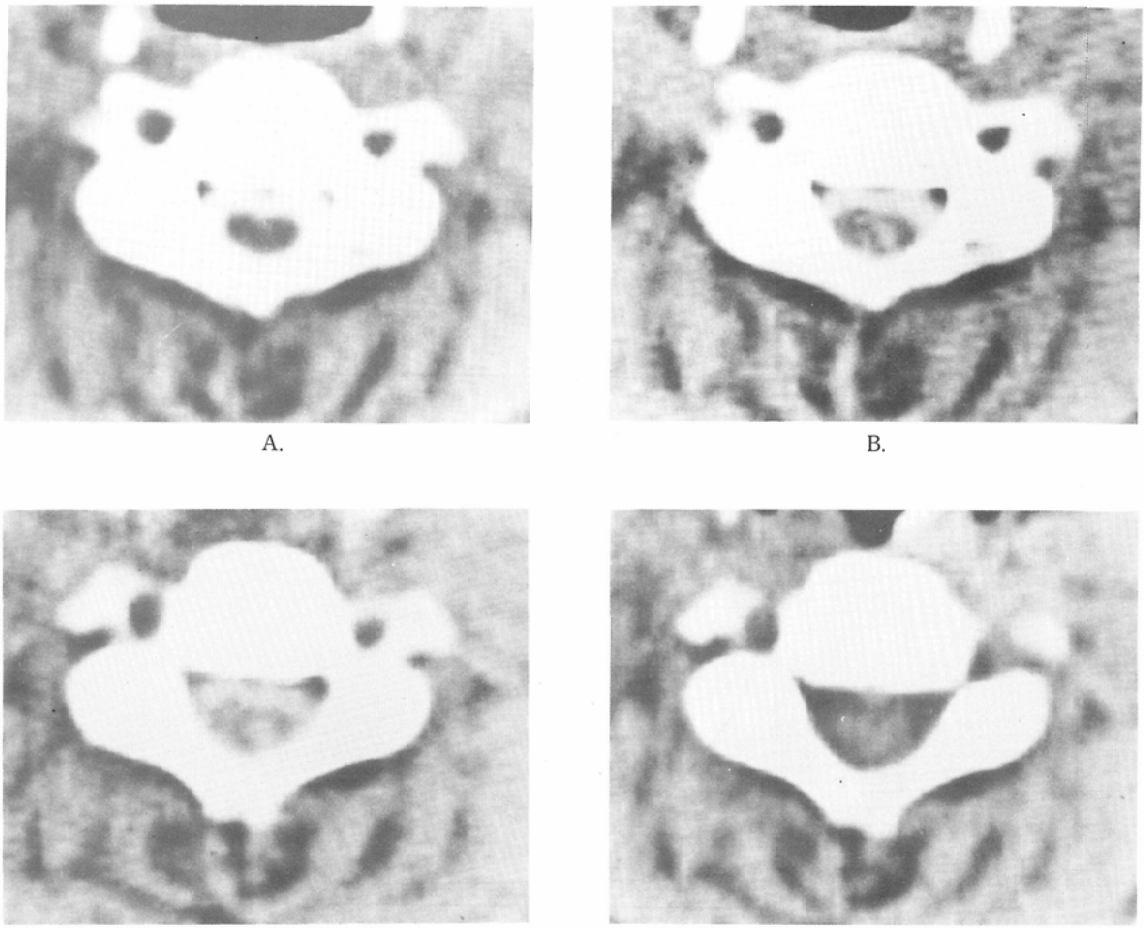
Fig. 2　Sequential changes in densities of the syrinx and subarachnoid space in case 1.

Discussion

For a definite diagnosis of SHM, it is essential that contrast media is demonstrated in the syrinx. The methods for evaluating SHM radiologically include gas myelography, oil myelography, and percutaneous spinal cord cyst puncture. However, these methods are not ideal for a number of reasons. In SHM gas myelography may be a reliable diagnostic tool demonstrating a collapsed cord, but the examination involves a somewhat complicated technique. In oil myelography, the inflow of oil into the syrinx may be accomplished by changing the patient's position but this is not easily achieved. Although the benefits of cyst puncture are both diagnostic and therapeutic, this is not the method of choice for evaluating SHM.

Di Chiro[6] reported that CT is ideal for screening and for follow-up observations of SHM patients; however, identification of the syrinx using non-high resolution CT is usually possible only in the superior cervical region. Bonafé et al.[4] demonstrated a central cavity in thirty-two patients using high resolution CT. The diagnostic value of non-contrast CT for SHM is limited, since a definite diagnosis and the differentiation of SHM from a cystic tumor is impossible with current CT technology .

Unlike non-contrast CT, MCTM can image the shape of the spinal cord. The involved portion of the



A. B.

C. D.

Fig. 3 Case 2. Sequential scans at one (A), three (B), six (C) and twenty-four hours (D). The spinal cord is of normal size. Inflow of metrizamide into the syrinx is seen at three and six hours and is also suspected at twenty-four hours.

cord may alternate in shape when the position of patient is changed[7]. Similar findings have also been observed with gas myelography as signs of a collapsing and contracting spinal cord. In a Chiari malformation, which is often associated with SHM, herniation of the cerebellar tonsils can also be demonstrated[2)7)]. With MCTM the syrinx itself and the length of the involved cord segment can be demonstrated in cases with communications between the SAS and the syrinx. In these instances, intraventricular instillation of metrizamide reported by Crolla et al.[8] and Foster et al.[9] is unnecessary. Bonafé et al.[10] performed sequential scanning at 3 and 24 hours for seven cases. At 24 hours, delayed inflow of metrizamide into the syrinx, was detected in three cases. At three hours, early opacification of the syrinx was demonstrated in one case. Results of our observations also indicated that metrizamide dynamics varied from case to case.

Though one hour after injection of metrizamide, MCTM showed no definite evidence of inflow of metrizamide into the syrinx in two of three cases, at three and twenty-four hours, and at six hours in one case, there was definite evidence of inflow of metrizamide into the area suspected to be the syrinx.

In one case, inflow of metrizamide was suspected at one hour using sequential scans, but this was questionable since there was no increase in the attenuation value of the syrinx.

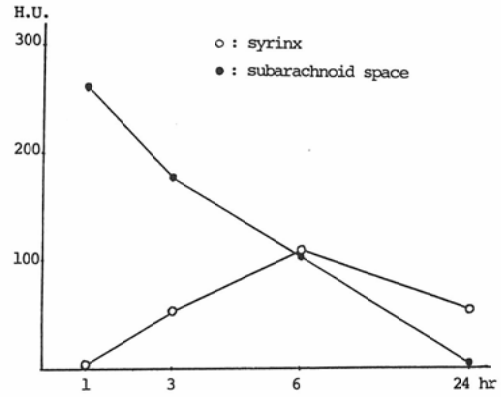


Fig. 4　Sequential changes in densities of the syrinx and subarachnoid space in case 2. The highest attenuation value of the syrinx is at six hours.

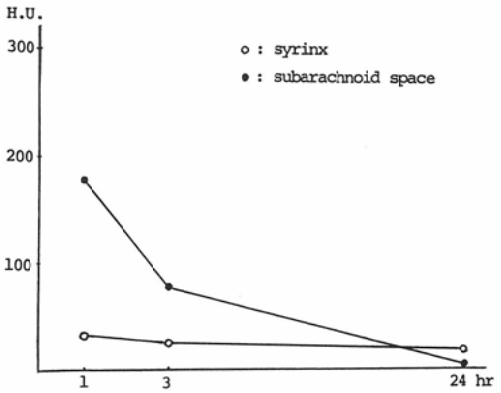


Fig. 5　Sequential scans in case 3. The curve of the attenuation values of the syrinx indicates that there is no definite inflow of metrizamide into the syrinx.

In one of two cases of the delayed type, at six hours the attenuation values of the SAS and the syrinx were nearly the same. Inflow of metrizamide into the syrinx is influenced by the concentration of metrizamide, the position of the patient during the interval prior to CT, the presence of a subarachnoid block, arachnoid adhesions, and arachnoiditis[3]. Bonafé et al.[10] suggested that the mechanism of filling the syrinx with metrizamide may involve a kind of ball-valve effect in the delayed type. However, we believe that the inflow of metrizamide into the syrinx depends mainly on the degree of communication or permeability between the hydromyelic cavity and the CSF pathways. Clinically, it is difficult to estimate the degree of communication, though the intraventricular instillation of a radioisotope or of metrizamide may demonstrate this[3)11)12]. Although this is a preliminary study, we were able to obtain valuable information about the dynamics of metrizamide in the SAS and the syrinx. The degree or rate of communication between the SAS and the syrinx may prognosticate the results of surgical intervention, but it is not yet clear which pattern of metrizamide dynamics can best do this. Nor is it clear which are the operative procedures of choice, such as closure of the orifice of the central canal or syringo-subarachnoid shunting. Further evaluation is necessary.

In most cases, scanning is best performed three or six hours after the instillation of metrizamide[13]. It is also advisable to scan twenty-four hours after the administration, since by that time the metrizamide in the SAS will be nearly completely diluted and the contrast medium may be clearly imaged only in the

syrinx, as in case 1. Forbes et al.[2], however, stated that in one case, metrizamide was imaged in the syrinx at the initial scan and disappeared after 24 hours.

MCTM is a highly sensitive mean for diagnosing SHM by demonstrating the spinal cord and the syrinx. With sequential scanning, it provides valuable information about metrizamide dynamics.

Conclusion

Three clinically suspected cases of syringohydromyelia were sequentially examined with metrizamide computed tomographic myelography, 1, 3 and 24 hours after the instillation of the contrast media. One also had CT 6 hours post-instillation. In two cases metrizamide was observed to flow into the syrinx. Three or six hour post-instillation scans seem to be adequate to observe this, but it may also be advisable to scan at twenty-four hours. Analysis of metrizamide dynamics will provide a valuable information for determining a diagnosis and surgical indication of syringohydromyelia.

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