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Delayed Spinal Subarachnoid Hematoma: A Rare Complication of C1–C2 Cervical Myelography

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The lateral C1–C2 needle insertion for cervical myelography is a valuable alternative to lumbar puncture and is considered a safe procedure. Mullen et al. [1] initially described this approach for cervical cordotomy and later Kelly and Alexander [2] adopted this technique for visualization of the spinal canal and its contents. Mullen early reported transient paresis and vertebral artery embolus as complications of this technique. Inadvertent puncture of the cervical cord and injection of contrast medium into the cord have also been reported as rare complications [3–6]. Only one instance of hemorrhage after C1–C2 puncture has been reported, in a patient with leukemia and a coagulopathy disorder [7]. In all patients with complications, symptoms were immediate and responded to either needle withdrawal, contrast resorption, or surgical intervention. We report a case of hemorrhage after C1–C2 puncture, in which symptoms were late and bleeding was localized to the cervical subarachnoid space. To our knowledge, our patient is the first reported case of cervical subarachnoid hematoma that complicated C1–C2 puncture for cervical myelography and that required surgical decompression.

Case Report

A 59-year-old woman was admitted to Allegheny General Hospital for evaluation of progressive numbness and weakness of the lower extremities and recent urinary incontinence. A previous thoracolumbar myelogram had demonstrated only lumbar spondylosis but no evidence of compromise of the spinal canal. On physical examination, she had mild unsteadiness on tandem gait, with no atrophy or fasciculations, generalized hyperreflexia in all four extremities, bilateral Hoffman responses, and equivocal Babinski responses bilaterally. To rule out a cervical cause of her progressive myelopathy, we performed a cervical myelogram via right C1–C2 puncture. The needle was inserted with lateral fluoroscopic guidance. The 20-gauge needle was directed just anterior to the spinolaminar line between the arches of the atlas and axis [8]. Return of clear, colorless spinal fluid was brisk. Metrizamide was then injected while its dispersion in the subarachnoid space was monitored with fluoroscopy. This study was normal.

The patient was asymptomatic for 36 hr after the myelogram, then developed abrupt cervical pain and headaches. When, over the next 4 days, she developed severe pain, more weakness in her lower extremities, and urinary retention, an emergency computed tomography (CT) scan was done (Fig. 1), which showed a hematoma in the cervical area. The patient underwent a complete laminectomy of C1 and C2. The dura appeared tense and discolored on the right posterolateral aspect. When the dura was opened, a large blood clot extending from C1 and C2 and confined externally by the arachnoid displaced the cord markedly from right to left. After the arachnoid was opened, the partially organized clot was evacuated. No evidence of vascular malformation or any other abnormalities of the spinal cord was seen.

After the operation, some strength returned to the patient's lower extremities and sensation improved in her feet. A postoperative CT scan showed the cord in normal position and no evidence of clot (Fig. 2). The patient continued, however, to have a neurogenic bladder and was subsequently transferred to a rehabilitation center. At the time of this writing, she has not recovered complete function and the underlying etiology of her myelopathy remains undetermined.

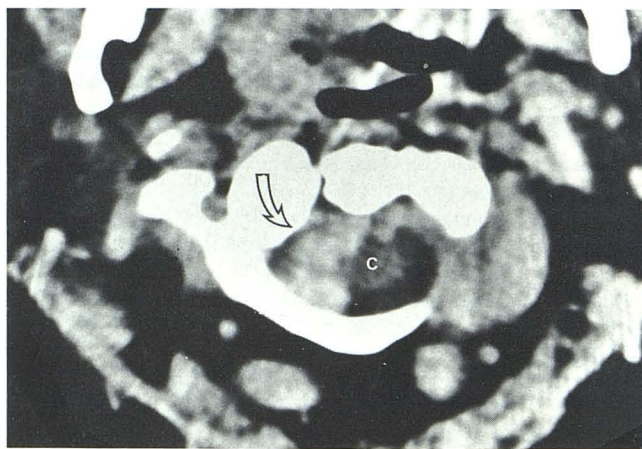


Fig. 1.—Transverse noncontrast CT scan at C1 level. Irregular high-density clot (arrow) surrounds lateral aspect of cervical cord (c), displacing it to the left.

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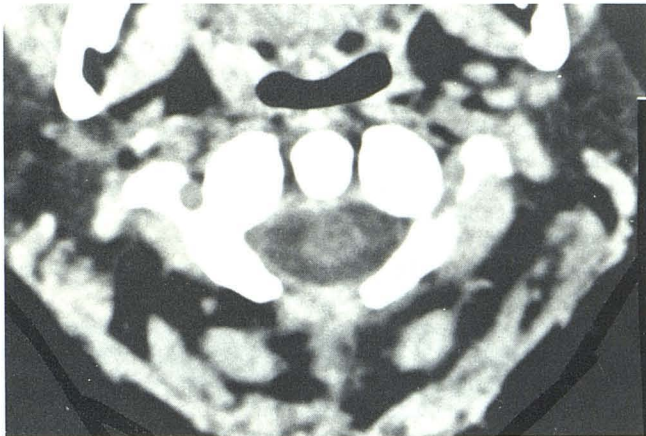


Fig. 2.—Postoperative noncontrast CT scan. Clot has been evacuated and cervical cord is now in normal position.

Discussion

The development of intraspinal hematomas is uncommon. When these do occur, virtually all occur in the epidural space. They develop spontaneously in approximately 50% of the reported cases [9, 10]. Spinal subarachnoid hematomas have been reported in association with arteriovenous malformations [11, 12], spinal cord neoplasms [13], intraspinal aneurysms [14], and other entities such as collagen vascular disorders, including systemic lupus erythematosus [15]. In the absence of demonstrable underlying pathologic states, spinal subarachnoid hemorrhage is extremely rare. In a review of the literature, only 12 cases of spinal subarachnoid hematoma are reported [16–25]. In all the reported cases, subarachnoid hematoma followed lumbar puncture and was of sufficient magnitude to compress the cauda equina and cause progressive neurologic deficit. Of the 12 reported cases of subarachnoid hematomas, only two had concurrent bleeding disorders [26]. The clinical syndrome was characterized by severe low back pain followed by progressive weakness of the lower extremities with the development of a sensory level and urinary retention. These symptoms occurred from a few hours to up to 10 days after lumbar puncture. Of the 12 reported cases, confirmation of the hematoma was obtained by surgery in six, autopsy in five, and by clinical diagnosis alone in one. The six surgical cases all had complete neurologic recovery after hematoma evacuation.

Although lateral C1–C2 puncture is recognized as a generally safe myelographic procedure, complications have been reported. Transient paresis has resulted from needle contact with the cord [4]. Cord puncture with intramedullary injection of a contrast medium has resulted in local pain [6] and even permanent paresis [5]. In these instances symptoms were immediate and responded to needle withdrawal, contrast resorption, or corticosteroid administration. Death associated with acute subdural hematoma has been described with lateral cervical puncture, although not as part of a myelogram [26].

The pathogenesis of the subarachnoid hematoma in our case remains obscure; no bleeding point or aberrant vessel

could be identified at surgery. No epidural hematoma was present, so the hemorrhage probably did not originate in the Batson epidural venous plexus. More likely, a radicular or subdural vessel was the source of bleeding. The long time interval between the time of puncture and the development of neurologic symptoms suggests that a vein or a very small artery progressively bled. Under normal circumstances subarachnoid hematomas are rare because of the diluting effect of the spinal fluid, the normal pulsation of the cord that tends to prevent clot formation, and the fibrinolytic activity of the spinal fluid itself [21].

In our case, a hematoma developed despite all the precautions taken in the insertion of the needle and the confirmation with radiographic landmarks. The primary purpose of this report is to alert neuroradiologists to the possibility of this complication, although it is extremely rare. Severe local pain that persists longer than the anticipated time after a C1–C2 puncture should alert the physician to the possibility (even though remote) of an epidural, subarachnoid, or subdural hematoma. If a hematoma is suspected, prompt CT provides an easy, direct method of evaluating the canal and has been helpful in demonstrating spinal epidural [27], subdural [28], and subarachnoid [29] hematomas. At this point, the therapeutic options must be correlated with the evolving clinical picture. If there is a clear syndrome of progressive neurologic loss, then rapid decompression should be carried out.

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