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Toothpaste artifact of the spinal cord observed in a victim of traffic accident who died of pulmonary thrombotic embolism after laminectomy

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Abstract

Toothpaste artifact of the spinal cord is generally known as artificial and morphological change in the field of neuropathology. It is considered that while the spinal cord is pressed on local parts with some solid bodies, the inner spinal tissue pressed penetrates into the weak vicinity of pressed parts and consequently pencil-shaped morphological change, toothpaste artifact, occurs. We report an autopsy case with toothpaste artifact of the spinal cord. A 77-year-old man, who was a front-seat passenger and was injured to the vertebra in a traffic accident, complained suddenly of dyspnea and precordial oppression during a rest on bed in a hospital 18 days after laminectomy, and he died of pulmonary embolism originated in thrombi in the deep vein of lower extremity. The toothpaste artificial change of spinal cord was microscopically observed at the near site of laminectomy. Slight bleeding was observed in a margin of the slipped area, but there was no reactive change. In present case, external compression of spinal cord which occurred accidentally during the period after the operation or at cardiopulmonary resuscitation seems to have caused the toothpaste artifact.

Keywords: Forensic pathology; Toothpaste artifact; Spinal cord

1. Introduction

Toothpaste artifact and pencil-shaped softening which are generally known in the field of neuropathology are unusual morphological change of the spinal cord [1-4]. But, those occur less frequently [3]. In horizontal section of the spinal cord, those show microscopically similar to a figure of the horizontal cutting surface of a lead pencil. Two main factors causing pencil-shaped softening are circulatory disturbance inducing tissue necrosis and mechanical compression of the spinal cord [1, 2]. It was reported that pencil-shaped softening is most frequently observed in compressing the spinal cord with extradural metastatic tumor, and is also observed in spinal cord injury, intramedullary spinal cord tumor and brain death [1, 4]. It is known that mechanical compression with inattentive dissection technique at the time of removing the spinal cord induces toothpaste artifact. Meanwhile, Hashizume et al. [1] indicates that toothpaste artifact prone to occur especially in the area of pathologic tissue condition such as infarcts or tumors. We report an autopsy case of a traffic accident victim who died during the hospital stay after operation of laminectomy, in which toothpaste artifact of the spinal cord was observed.

2. Case history

A 77-year-old man sitting on the front seat of a mini-vehicle was injured on March 28th in a frontal collision traffic accident between his vehicle and a standard-size car after slowing

down in speed by braking their cars with each other. He was told to undergo 5 days of treatment in a doctor's office where he visited soon after the accident and was diagnosed as cervical vertebrae sprain and bruises of the chest, shoulder and lower back. He had a progressive worsening of symptoms which continued after returning to his home.

Because of the continued pain and gait disorder, he visited an orthopedic hospital and admitted into the hospital on March 31st. However, symptomatic therapy was performed, feeble muscle of his lower extremities continued, and his symptoms progressed to cystoplegia and complete motor paralysis of the lower extremities.

He moved to another general hospital on April 11th for the purpose of performing operative treatment, and laminectomy was performed in the levels of Th11 and Th12 of the thoracic vertebrae following the diagnosis of compressed fractures of thoracic vertebrae and spinal epidural hematoma in those levels. But, his symptoms, severe palsy and motor weakness of the lower extremities, sill continued after the operation.

He had an onset of mild coughing on April 19th and it continued. He suddenly went into severe dyspnea with tachycardia and a narrow pulse pressure on May 1st, lasting 5 days, and tightness of the chest occurred lastly, and he died during cardiopulmonary resuscitation on May 6th. Clinically-diagnosed cause of death was acute cardiac failure due to pulmonary infarction. Autopsy was performed 18 hours after death.

3. Autopsy findings

Autopsy revealed pulmonary embolism in the pulmonary trunk, which originated in thrombi in the deep veins of lower extremities and was slightly crushed by chest compression during cardiopulmonary resuscitation.

The spinal cord was extirpated carefully by dorsal thoracic approach at autopsy, and the formalin-fixed spinal cord was microscopically investigated after making transverse sections of the spinal cord adjacent to the operative site of laminectomy. Tissue sections were stained with hematoxylin-eosin (HE) and Bodian methods.

The toothpaste artifact of spinal cord (Fig. 1, 2) was observed in upper region from the level of laminectomy. The slipped tissue of the spinal cord located in the lateral cord and posterior column, which had a clearly demarcated margin with tissue slit from the compressed surrounding tissue. Swelling and wavy-shaped change of axon were slightly observed in slipped part of the spinal cord tissue. Softening of the slipped tissue was not observed. Slight bleeding was recognized in the slit region, but there were no reactive changes in both the slipped part and the compressed surrounding tissue.

4. Discussion

Ischemic tissue change due to circulatory disturbance by various pathologic condition and mechanical compression of the spinal cord are main factors causing the pencil-shaped

softening [1, 2]. There is a clear demarcated border between softening tissue region and the compressed surrounding tissue [1, 2]. Necrotic debris and macrophage are often recognized in the softening tissue region, but reactive changes are rare in the compressed surrounding tissue [1, 2]. In our case, the demarcated border between the slipped invasive tissue region and the compressed surrounding tissue was also clear. Our case showed slight axonal swelling and wave-shaped arrangement of axon in the slipped tissue region, but softening or necrotic tissue were not observed. Pencil-shaped change in our case seems to be toothpaste artifact.

The neurological symptom of the patient became worse and continued after operation. We could not confirmed necrosis of the spinal cord macroscopically and microscopically at the level of injured vertebra, however, tissue weakness of the spinal cord by traumatic ischemic deficit seems to have occurred. Some kind of pressed force seems to have compressed the vulnerable parenchymal tissue of the spinal cord in the level of operative site. In the result, the pressed vulnerable parenchymal tissue slid into adjacent compressed part, and toothpaste artifact in our case occurred above adjacent part of the level of operative site.

Potential external force compressing the spinal cord and accordingly causing toothpaste artifact in our case are compressions by thoracic vertebral fracture due to traffic accident, inadequate surgical technique of operating laminectomy, some kind of accidental compression during the hospital stay, some kind of compression during carrying the victim's body to an autopsy room, chest compression during cardiopulmonary resuscitation and inattentive

dissection technique at the time of removing the spinal cord. In those possible compressions, we consider that toothpaste artifact occurred in life, particularly in terminal phase of living, or during cardiopulmonary resuscitation, since slight bleeding in the demarcated border and red blood cells without elution of hemoglobin were observed.

Conflict of Interest: None

References

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Legends to figures

Fig. 1. Toothpaste artifact of the spinal cord. Bodian stain, ×loupe size.

Fig. 2. Slipped and invaginate part of spinal cord. Bodian stain, ×20 ~ 400

Figure

Fig. 1

Figure

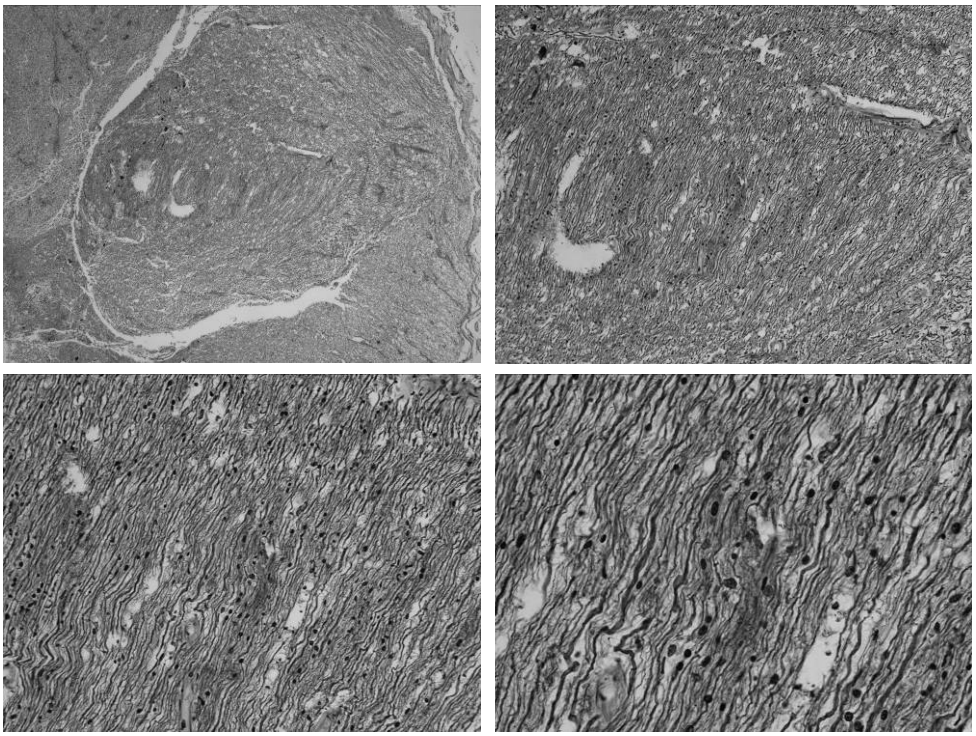

Fig. 2