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Gelfoam Granuloma Formation and Myelopathy after Posterior Decompression in Thoracic Spine - A Case Report -

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Study design: A case report.
Objectives: To document that Gelfoam®(Pharmacia & Upjohn, Kalamazoo, MI) contributes to granuloma formation and spinal cord irritation by immune response.
Summary of Literature Review: The Gelfoam® or microfibrillar collagen applied during various operation for hemostasis. Some complications of Gelfoam®, such as mechanical cord compression, postoperative swelling and mass effect in closed cavity have been reported.
Materials and Methods: The patient was underwent posterior decompression and instrumented posterolateral fusion under the diagnosis of the ossification of ligamentum flavum at T10-11 and T11-12. In operation, Gelfoam® was used at epidural space. She complained of sensory deterioration and muscle weakness around lower extremities after 10days postoperatively. A second operation was performed.
Results: Postoperatively, the patient immediately improved motor grade except spasticity. She is under observation.
Conclusion: Gelfoam® at epidural space after posterior decompression can result hyperactive immune reaction and irritate spinal cord.

Key words: Gelfoam®, Immune reaction, Spinal fusion

The absorbable gelatin sponge Gelfoam® (Pharmacia & Upjohn, Kalamazoo, MI) is used in many surgeries on account of its potent hemostatic effect. Particularly, in multi level spine fusion, due to persistent hemorrhage in the exposed cancellous bone and adjacent soft tissues, hematomas are formed during surgery and thus risk for infection is high, and hemorrhage volume is large consequently risk for developing complications is also high, and thus it is used commonly in the epidural space. However, we experienced a case that in spine surgery, the use of Gelfoam® win the epidural space after posterior decompression induced immune reaction resulting in myelopathy and spine irritation symptoms caused by Gelfoam®. The case is reported.

CASE REPORT

A 50 years old female patient had back pain and bilateral radiating pain in the lower extremities started from 2 years ago. The pains were not diagnosed and treated, and from 1 year ago, weakness of the left lower extremity was developed. The symptoms became severe from one month prior to hospitalization. Magnetic resonance imaging was performed at another hospital, and transferred to our hospital. In physical examination, the power of hip flexion and the power of knee extension were 4 points out of maximal 5 points of muscle strength testing. The power of ankle dorsiflexion, the power of ankle plantar flexion and the power of great toe dorsiflexion

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were lowered to 3 points, and radiating pain in the entire lower extremities was shown, nonetheless, hypoesthesia was not shown. The patient showed mild gait disturbance. In magnetic resonance imaging (Fig. 1), the findings of the ossification of yellow ligament of the 10th−11th and 11th −12th thoracic vertebra and the areas with high signal intensity within the spinal cord caused by compression were observed. The 10−11−12 thoracic vertebrae of the patient were treated by wide posterior decompression, and poserolateral fusion using pedicle screws with autologous local bones was performed (Fig. 2). At the time of surgery, in the area where posterior decompression was performed, Gelfoam® 1 x 3 cm in size was used in the epidural space for bleeding control.

One day after surgery, the power of hip flexion and the power of knee extension were 5 points. The power of ankle dorsiflexion, the power of ankle plantar flexion, and the power of great toe dorsiflexion were 4−5 points, and hypoesthesia was not shown. Normal walking was initiated from 3 days after surgery. From

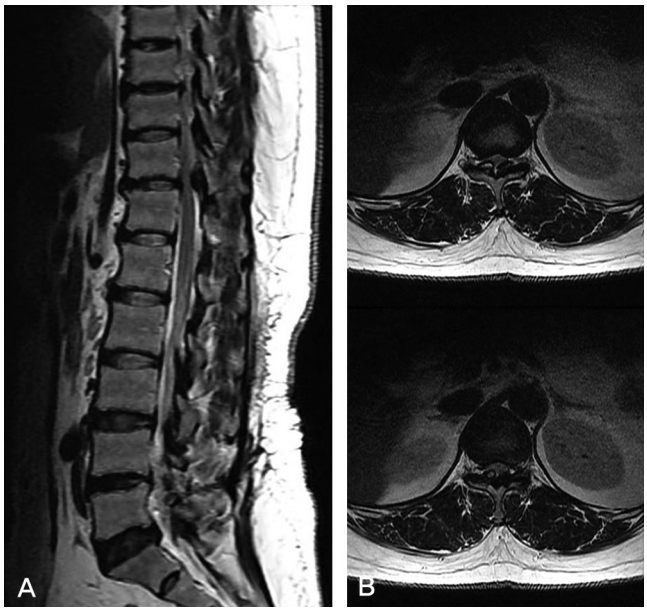

Fig 1. Magnetic resonance imaging showing epidural tumor compressing thoracic spinal cord. **(A)** T-2 weighted saggital images showing OLF compressing thoracic spinal cord. **(B)** T-2 weighted axial images showing OLF compressing thoracic spinal cord.

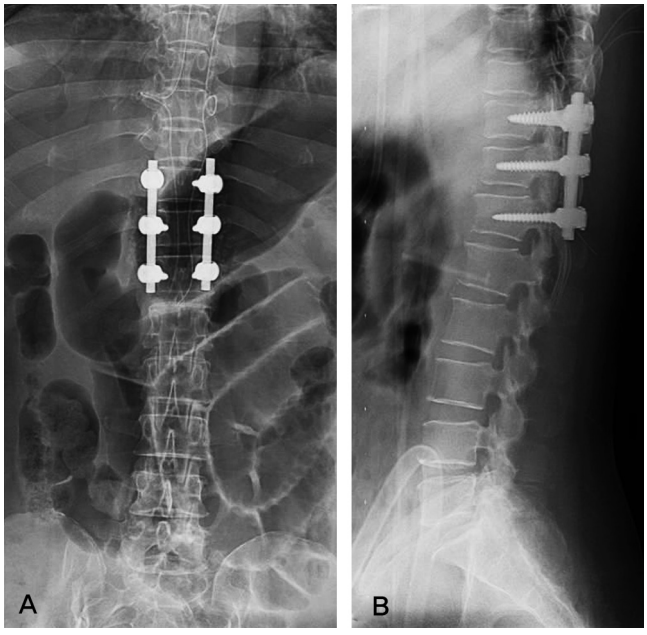

Fig 2. Immediate postoperative x-rays after posterior decompression and instrumented posterolateral fusion. **(A)** AP view. **(B)** Lateral view.

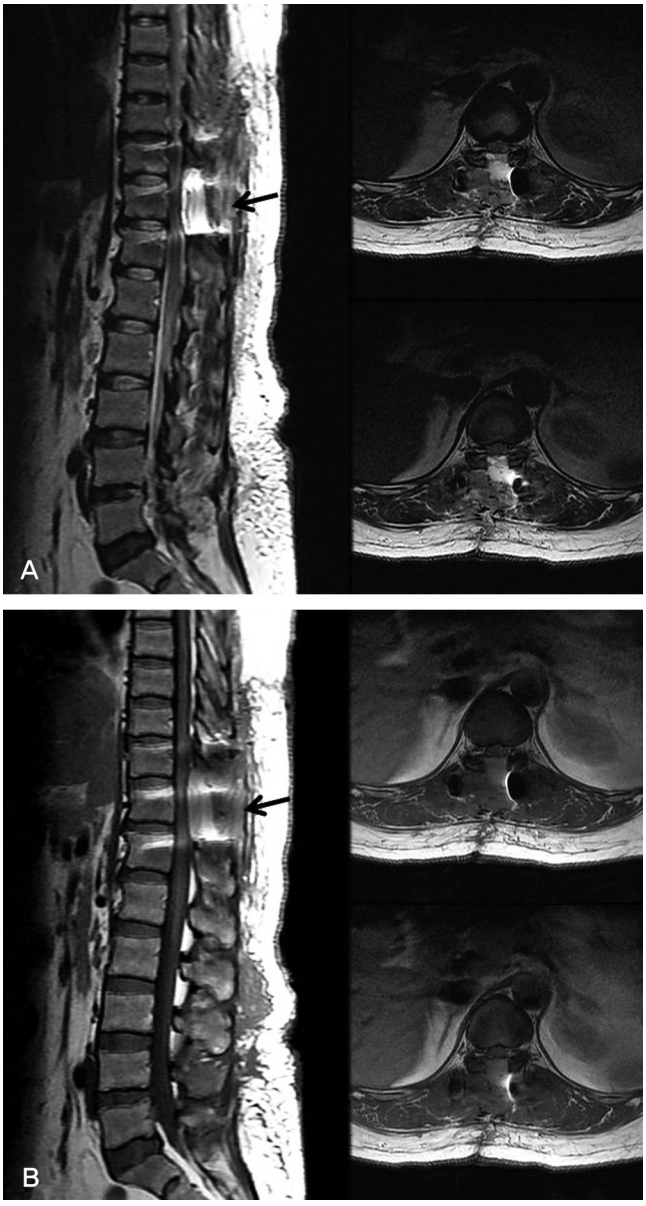

Fig 3. Magnetic resonance imaging showing epidural Gelfoam® mildly compressing thoracic spinal cord. **(A)** T-2 weighted saggital and axial images showing Gelfoam® on the thoracic spinal cord. **(B)** T-1 weighted saggital and axial images showing Gelfoam mildly compressing thoracic spinal cord.

7 days after surgery, the gradual weakening of the power of the lower extremities was shown. 10 days after surgery, suddenly, the overall muscle power of the lower extremities was lowered to 1−2 points. In the physical examination performed at that time, findings that could be suspected to be spinal myelopathy or infection were not detected, hence, magnetic resonance imaging was performed without contrast enhancement. In magnetic resonance imaging (Fig. 3), the findings of hematomas that compress the spine or seromas were not observed. Nonetheless, findings of mild spinal compression caused by the Gelfoam® as well as water retention at the general level after surgery were observed. During follow−ups, the deterioration of the muscle power of the lower extremities was not improved, and myelopathy symptoms such as hyperactive deep tendon reflex were deteriorated, and thus on the day 12 after surgery, the exploration was performed.

At the time of surgery, macroscopically, compression of the spine in the epidural space by the hardened Gelfoam® was observed, it showed noticeable adhesion to the adjacent dura. It was dissected carefully and removed (Fig. 4). In microscopic findings, phagocytosis of the Gelfoam® by macrophages was observed, and the finding of granulomas with the infiltration of lymphocytes was observed (Fig. 5). In physical examination performed after 2nd surgery, the power of the flexion of the left hip and the power of knee extension were 4 points, the power of ankle dorsiflexion, the power of ankle plantar flexion, and the power of great toe dorsiflexion were improved immediately to 5 points. Myepathy symptoms remained partially, and the patient is under the follow−up observation currently.

DISCUSSION

The prevention of bleeding during surgery is an important task for most surgeons, and particularly, in the spine surgery field, prevention of bleeding may be a more important tasks. As hemostatic methods during surgery, in addition to direct cauterization or ligation of bleeding areas, hemostatic agents are administered systemically or local hemostatic materials are applied. In spine surgery, however, cauterization may cause direct thermal injury, and systemic hemostatic agents may cause deep vein thrombus, pulmonary embolism, renal failure and other complications. thus, the method using local hemostatic materials have been diversely applied in the spine surgery field.

Gelfoam® is a commercialized hemostatic sponge based on gelatin. Gelfoam® is absorbable gelatin sponges, it is a hemostatic material obtained from the purified pig skin. Although it does not mediate hemostatic reactions directly, it has multiporous structures and absorbs a large volume of blood, hence it mediates hemostatic reactions by compressing bleeding areas. Since

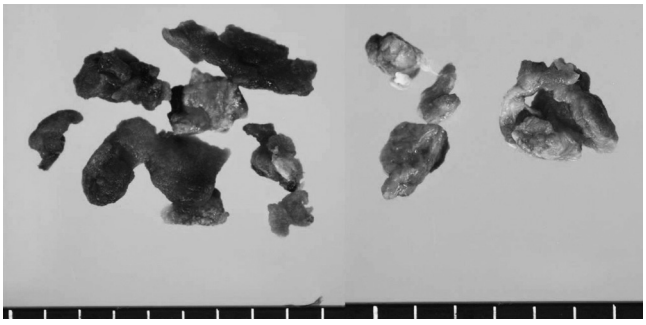

Fig 4. Gross photographs. Hardened and thickened Gelfoam® adhesive to dura mata was found and removed.

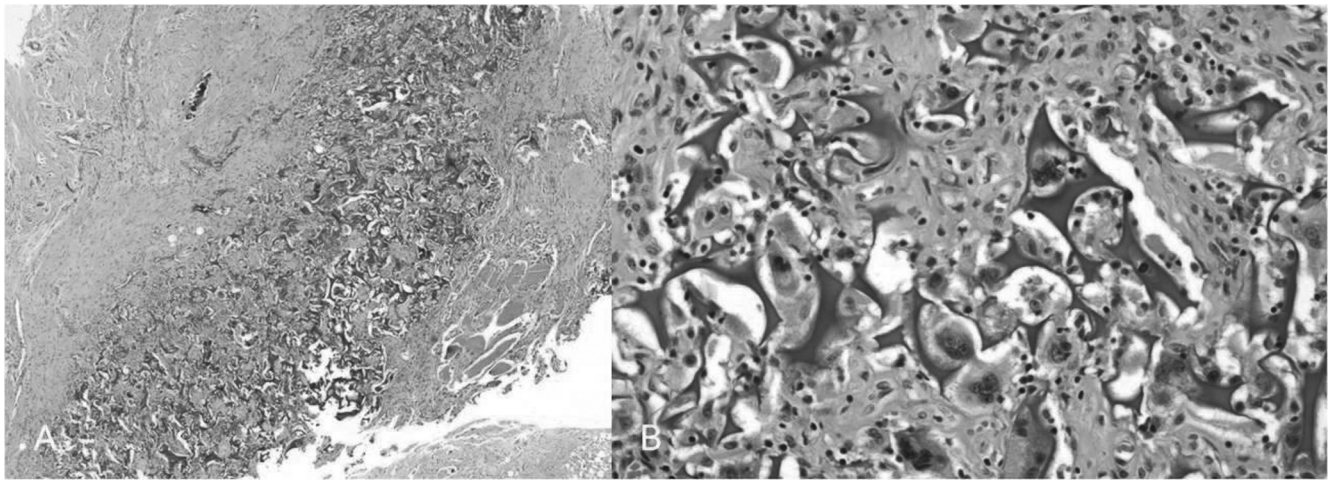

Fig 5. Microscopic photographs. Grauloma formation. Gelfoam® was destructed by polynucleated giant cell and infiltrated by lymphocyte. **(A)**H&E stain, original magnification ×100. **(B)**H&E stain, original magnification ×400.

bioreactivity is relatively low, it is used in diverse surgeries.[1,2] In addition, it has been used widely in spine surgery as a barrier membrane that prevents adhesion of adjacent tissues. However, even in the manual, it is warned that used in a limited space, the space occupying lesion may be developed, and immune reactions may be developed, however, most surgeons overlook the side effects of Gelfoam®.

In addition, in spine surgery, Friedman and Whitecloud[3] have reported in a study conducted on cauda equina syndrome which was developed 13 days after laminectomy performed on the lumbar vertebra that spinal cord compression may be developed due to the occupation of the space by excessively used Gelfoam®. Herndon et al.[4] have reported complications related with the spinal cord compression induced by Gelfoam® that was developed after posterior decompression and fusion in the thoracic vertebrae. Epstein et al.[5] have reported that in cervical spinal stenosis patients, Gelfoam® was used after laminectomy, and 3 weeks after surgery, cervical myelopathy was deteriorated, and thus the Gelfoam® was removed surgically, and the myelopathy was improved. In our study, slight water retention was detected by magnetic resonance imaging, but noticeable spinal cord compression was not observed. In surgical findings, similarly, it was observed that the Gelfoam in the epidural space adhered to the dura markedly, but spinal cord compression was not observed. However, the patient presented with severe myelopathy and deterioration of the kinesis of the lower extremities.

Shenoi et al.[6] have reported sensorineural hearing loss after stapedectomy of the middle ear, and when Gelfoam® was used in a limited space, immune reactions that were mediated by multinucleate giant cells elevated internal pressure, which could induce injury of adjacent nerves injury, and thus in addition to physical stimulation of Gelfoam® by occupying the space, the possibility of immunological stimulation was suggested. In addition, Knowlson[7] has reported a case that Gelfoam® which was used in the epidural space after the resection of oligodendroglioma induced the formation of granulomas of giant cells, and thus obstruction of cerebrospinal fluid was developed. In histological examination, it was observed that rather than compression caused by space occupying lesion, revascularization was induced due to the formation of thrombi in adjacent blood vessels, the Gelfoam® was destroyed by the phagocytosis of multinucleated giant cells, granucocytes proliferated, and fibrosis was progressed within tissues. This suggests that the immunological mechanism within tissues itself against the Gelfoam® may exert the tissue effects. In our case, similarly, in histological findings, granulomas were formed and many multinucleated giant cells were observed, and thus it was found that excessive reactions against a foreign body occurred.

Normal immunologic mechanism to the foreign body is that monocytes are accumulated due to the proliferation of inflammatory cells, and macrophages differentiate and phagocytize foreign materials, and macrophages again fuse with each other and form multinucleated giant cells, and form granulomas. Blaine[8] has reported histological changes of Gelfoam® in the liver and muscle tissues in animal experiments using dogs. Experimentally, it was observed that Gelfoam® within tissues absorb blood in the vicinity and surrounded by thrombi. at 3 days On 12 days after surgery, the reactions within tissues reach the peak, and Gelfoam® in vivo is absorbed by fibroblasts, lymphocytes, and multinucleated giant cells, and the period form 4 weeks to 6 weeks is required for Gelfoam® in vivo being absorbed. In our case, the symptoms were initiated from 10 days after surgery, and it could be considered to be identical to the time of the initiation of immune reaction against the Gelfoam® as shown in the study reported by Blaine.[3]

Our patient was the case that Gelfoam® which was applied to the epidural space after surgery for thoracic vertebrae induced myelopathy by forming giant cell granulomas through immunological mechanisms, and it was removed by surgery. Formation of giant cell granulomas is a normal immune reaction. Nonetheless, excessive formation of giant cell granulomas by Gelfoam® may induce fatal side effects. Based on our case, when Gelfoam® is used, we recommend to pay attentions not only on physical compression but also side effects caused by immunological reactions.

REFERENCES

1. Harris WH, Crothers OD, Moyen BJ. Topical hemostatic agents for bone bleeding in humans. A quantitative comparison of gelatin paste, gelatin sponge plus bovine thrombin, and microfibrillar collagen. J Bone Joint Surg Am. 1978;60:454-6.

2. Tomizawa Y. Clinical benefits and risk analysis of topical hemostats: a review. J Artif Organs. 2005;8:137-42.
3. Friedman J, Whitecloud TS. Lumbar cauda equina syndrome associated with the use of Gelfoam: case report. Spine (Phila Pa 1976). 2001;26:E485-7.
4. Herndon JH, Grillo HE, Roseborough EJ, Rich JC. Compression of the brain and spinal cord following use of Gelfoam. Arch Surg. 1972;104:107.
5. Epstein NE, Silvergleid RS, Hollingsworth R. Increased postoperative cervical myelopathy and cord compression resulting from the use of Gelfoam. Spine J. 2009;9:E19-21.
6. Shenoi PM, Ballantyne JC, Bredberg G. Absorbable gelatin sponge B.P. (sterispon) and poststapedectomy sensorineural hearing loss: a phase contrast microscopic report on the human temporal bone. J Laryngol Otol. 1975;89:159-68.
7. Knowlson GT. Gelfoam granuloma in the brain. J Neuro Neurosurg Psychiatry. 1974;37:971-3.
8. Blaine G. Absorbable gelatin sponge in experimental surgery. Lancet. 1951;2:427-9.

흉추 후방감압술 후 Gelfoam 육아종 형성 및 척수증 - 증례보고 -

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연구 계획: 증례 보고
목적: 본 논문은 후방감압술 후 경막 외 공간에 사용한 Gelfoam®에 의한 면역학적 반응으로 척수증 및 척수 자극이 일어날 수 있음을 보고한다.
선행 문헌 요약: 흡수성 젤라틴 스폰지인 Gelfoam®(Pharmacia & Upjohn, Kalamazoo, MI)은 강한 지혈작용의 장점 때문에 많은 수술에서 사용되고 있다. 그러나 척추 수술에 있어 후방감압술 후 경막 외 공간에 Gelfoam®을 사용하는 경우 공간 점유에 의한 척수 압박을 일으킬 수 있다.
대상 및 방법: 본 환자는 흉추 제 10-11번, 제 11-12번의 황색인대 골화증 소견 및 척추관 압박으로 흉추 제 10-11-12번에 대해 광범위 후방감압술을 시행 받았고 자가 국소골 이식술과 함께 척추경 나사를 이용한 후외방 유합술을 시행받았으며 술 중 Gelfoam®이 경막 외 공간에 사용되었다. 술 후 10일에 갑자기 하지의 근력이 전반적으로 1-2점으로 감소하여 재수술하였다.
결과: 2차 수술 후 하지의 근력은 호전되었으며 척수증 증상은 일부 남아있으며 현재 경과 관찰 중이다.
결론: 저자들은 증례 보고를 통해 Gelfoam®에 의한 물리적 압박 외에도 면역학적 반응을 통한 부작용에 대해 주의를 기울이길 권고하는 바이다.

색인 단어: Gelfoam®, 면역 반응, 척추 유합술
약칭 제목: Gelfoam 육아종 형성 및 척수증