

## Case Report



# Dorsal Epidural Gas after Lumbar Microdisectomy Treated with CT-guided Needle Aspiration

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### Conflict of Interest

The authors have no financial conflicts of interest.

## ABSTRACT

To present a case of unusual dorsal epidural gas (EG) accumulation after a simple lumbar microdisectomy (MD), treated with computed tomography (CT)-guided needle aspiration. A 78-year-old woman underwent simple lumbar MD at the L3–4 level. One week after the operation, the patient complained of severe back pain radiating to the right thigh. Follow-up magnetic resonance imaging (MRI) and CT revealed huge EG formation at the dorsal L3–4 epidural space. Conservative treatment did not resolve the patient's pain. We performed CT-guided needle aspiration after 1 week of conservative treatment. The patient's pain fully resolved after aspiration, but it recurred 1 week later. Follow-up MRI and CT revealed re-accumulation of the dorsal EG at the L3–4 level. CT-guided needle aspiration was repeated, again leading to full pain resolution. Follow-up CT 6 months after the second aspiration showed no recurrent dorsal EG. The patient has been symptom-free for 1 year since the second aspiration. CT-guided needle aspiration is a safe and effective alternative to re-operation in the context of dorsal EG formation after MD.

**Keywords:** Needle aspiration; Epidural space; Discectomy

## INTRODUCTION

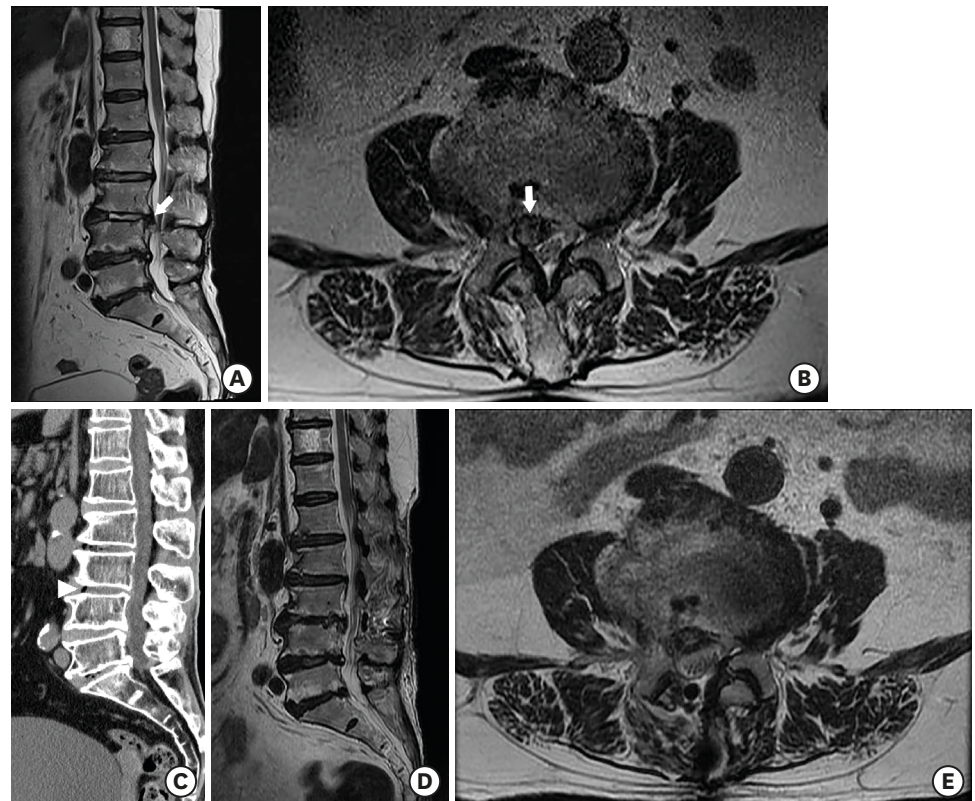
Spinal epidural gas (EG) is a radiological finding familiar to the spine surgeons. It could be observed in association with degenerative disc disease, spinal tumors, spinal infection, spinal trauma, and iatrogenic processes.<sup>1,3,14,15-20</sup> Gas liberation from the intervertebral disc to epidural space is relatively common. Although EG formation is usually asymptomatic, there have been several reports of symptomatic EG causing severe back pain or radiculopathy.<sup>2,20</sup> Symptomatic EG after lumbar microdisectomy (MD) is rare. To the best of our knowledge, there have only been eight reported cases of symptomatic EG formation after lumbar MD.<sup>13</sup> Herein, we report an unusual presentation of EG formation after simple lumbar MD.

## CASE REPORT

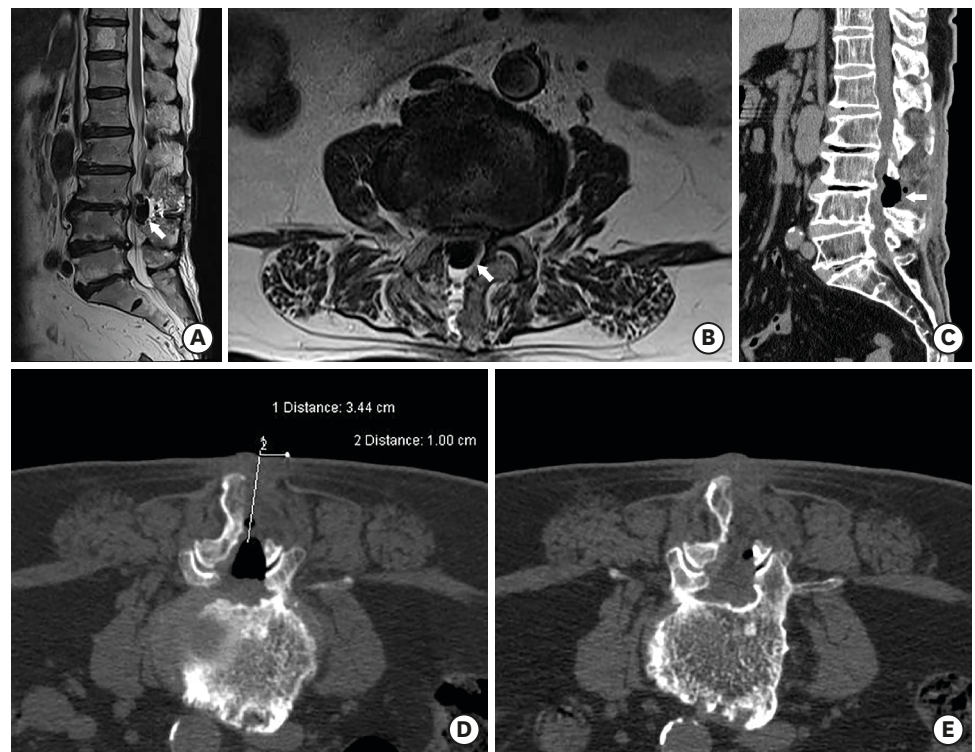
A 78-year-old woman with sudden right-sided radiating pain and paresthesia of the anterior thigh was admitted to our clinic. The severe radiating pain prevented the ascertainment of the

presence of motor weakness upon neurological examination. Magnetic resonance imaging (MRI) and computed tomography (CT) scans revealed moderate degenerative intervertebral disc changes, disc herniation, and a discal cyst at the L3–4 level (**FIGURE 1**). A small amount of gas was also observed at the anterior L3–4 intervertebral disc. Laboratory tests were all within normal ranges. The patient underwent right partial hemilaminectomy and MD at the L3–4 level under epidural anesthesia at the L1–2 level. Intraoperatively, we identified a small stalk between the discal cyst and the downwardly extruded disc. We successfully removed the discal cyst and the extruded disc material. After the aforementioned steps, we explored the intervertebral disc space using small pituitary forceps through the annular defect. As the intervertebral disc was confirmed to be friable as a result of degeneration, we partially removed the friable intervertebral disc material using small pituitary forceps to reduce the re-herniation risk. Small Hemovac drain (100 mL capacity) was placed and carried out through a separate stab incision. Hemovac was removed the first postoperative day. Her symptoms fully resolved after the procedure. Postoperative MRI on the second postoperative day, confirmed that the herniated disc and discal cyst were successfully removed, with a small amount of EG located at dorsal epidural space (**FIGURE 1**). We considered that this small amount of dorsal EG was made during Hemovac catheter removal.

One week postoperatively, the patient complained of severe back pain and anterior thigh pain. Follow-up MRI and CT revealed huge dorsal EG severely compressing the dural sac at the L3–4 level (**FIGURE 2**). The intervertebral gas volume was higher than that observed



**FIGURE 1.** Preoperative MRI and CT scan (A, B, C) showed extruded and inferiorly migrated disc material (arrow) from right central to subarticular zone, and intervertebral gas formation at L3–4 level (arrowhead). Postoperative MRI scan (D, E) showed well-removed extruded disc material and small amount of dorsal EG. CT: computed tomography, EG: epidural gas, MRI: magnetic resonance imaging.

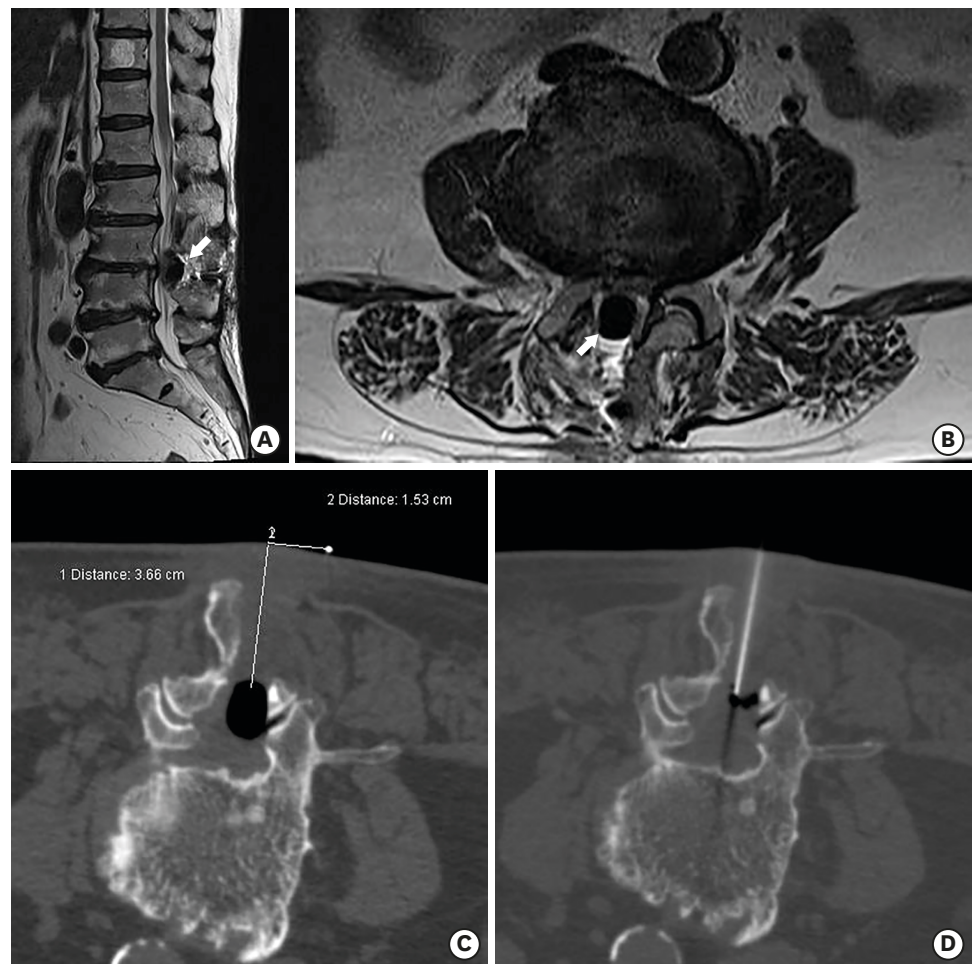


**FIGURE 2.** Follow-up MRI and CT scan a week after operation (A, B, C) showed huge dorsal EG accumulation (arrow), which compressed the dural sac at the L3–4 level and increased the intervertebral gas pressure. A percutaneous needle approach was safely performed under CT guidance (D). After the gas aspiration, the re-expanded dural sac was identified (E).

CT: computed tomography, EG: epidural gas, MRI: magnetic resonance imaging.

preoperatively and immediately postoperatively. Of note, there was no definite disc re-herniation. Considering the likelihood of gas inflow to the epidural space from surgical wound, we checked for surgical wound dehiscence including Hemovac insertion site, but the wound was clean and well healed. Her pain worsened despite conservative management, including absolute bed rest (ABR), analgesics, and steroids. We performed CT-guided needle aspiration at the L3–4 level after 1 week of conservative treatment (**FIGURE 2**). The dorsal EG was mostly aspirated, and the dural sac was successfully decompressed (**FIGURE 2**). The patient continued ABR after the aspiration. Her symptoms were fully resolved immediately after the aspiration procedure, but pain recurred with gradually increasing severity, day by day. A follow-up MRI scan was performed 1 week after the aspiration procedure, which revealed re-accumulation of dorsal EG at the L3–4 level (**FIGURE 3**). CT-guided needle aspiration was repeated, and the dural sac was sufficiently decompressed (**FIGURE 3**). Six months after the second aspiration, follow-up CT showed no recurrent dorsal EG and a small amount of ventral EG. The patient has been symptom-free for 1 year since the second aspiration (**FIGURE 4**).

We obtained informed consent from the patient and approval from the Institutional Review Board of Hospital (KNUH 202008013).



**FIGURE 3.** Follow-up MRI scan 1 week after the first aspiration (A, B) showed re-accumulation of the dorsal EG (arrow) at the L3–4 level. CT-guided needle aspiration (C, D) was repeated successfully. CT: computed tomography, EG: epidural gas, MRI: magnetic resonance imaging.

## DISCUSSION

The vacuum disc phenomenon usually results from an accumulation of gas, composed principally of nitrogen (90%), that occurs during the process of disc degeneration.<sup>20)</sup> Disc degeneration results in a cavity or cleft in the disc, and this intradiscal space collects gas dissolved in surrounding fluids under sub-atmospheric pressure.<sup>8,14)</sup> Gas in the cleft does not spontaneously reabsorb and is not replaced by liquid because of avascularity in the degenerative disc.<sup>8)</sup> If an annular tear occurs and pressure is applied to the when a person is standing upright,<sup>4)</sup> gas in the cleft can be released into the epidural space, mostly on the ventral side. This mechanism of EG accumulation from intervertebral discs has been noted in several studies.<sup>6,7,10)</sup> Given this mechanism, it is easily assumed that MD could be among the causes of EG formation because enlarged annular tears after MD are conducive to postoperative gas transference from disc to epidural space. If an intervertebral discectomy is performed alongside MD, the cavity for gas accumulation in the intervertebral disc could be enlarged. This enlarged cavity could increase the probability of EG formation, which is otherwise a rare event. Therefore, we assume that the huge EG formation in the patient presented might have been partially explainable by the additional intervertebral discectomy,



**FIGURE 4.** CT imaging findings 6 months after the last aspiration (A, B) showed no dorsal EG and a very small amount of ventral EG at the L3–4 level. EG: epidural gas.

considering the highly increased amount of gas in the disc noted on postoperative CT (relative to the preoperative CT). Another reason for the huge EG formation after MD could have been excessive postoperative physical activity. Our patient walked around the ward strenuously, hoping to accelerate her recovery and discharge. It cannot be ruled out that excessive activity increased the motion of the operated-upon lumbar region, and this frequent motion provoked intradiscal gas liberation to the epidural space.

Symptomatic EG after lumbar MD has been reported a few times.<sup>3,9,12,13,17,18)</sup> All previously reported EG formation associated with recurrent symptoms were found in the ventral epidural space. Kaymaz et al.<sup>12)</sup> reported symptomatic EG located in the ventromedial and dorsal epidural space after MD, but the dorsal EG in this case did not compress the dural sac. Considering anatomical distances from the annulus, it is no wonder that the probability of ventral EG formation after lumbar MD is higher than that of dorsal EG formation because the ventral epidural space is closer to the annulus than the dorsal epidural space. However, in our patient, EG was mostly in the dorsal epidural space. To the best of our knowledge, this is the first case of symptomatic dorsal EG formation after lumbar MD. It seems that dorsal EG formation correlates with the amount of EG. It is obvious that the ventral epidural space is smaller than the dorsal epidural space at the postoperative MD level. While the ventral epidural space is still surrounded by annulus, pedicle, and dura after MD, the dorsal epidural space would be larger posteriorly due to partial laminectomy after MD. Because of this space limitation, the ventral epidural space can embrace only a small amount of EG. In light of this, it can be assumed that when the amount of ventral EG increases, to the extent whereby the ventral epidural space cannot accommodate all of the accumulating gas, the EG may begin to move along the ipsilateral side of the laminectomy and accumulate in the dorsal epidural space, which can accommodate more gas than the ventral epidural space. Furthermore, once the amount of dorsal EG increases enough to flatten the dural sac ventrally, gas in the disc could have a direct pathway to the dorsal epidural space without staying in the ventral

**TABLE 1.** Features of symptomatic epidural gas accumulation after lumbar microdisectomy in previous reports

| Reference                             | Year | Age (yr)/Sex | Operation level | Postoperative course                                                                            | Imaging findings (MRI or CT)                                    | Treatment                                                                                                 |
|---------------------------------------|------|--------------|-----------------|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Raynor and Saint-Louis <sup>17)</sup> | 1999 | 35/M         | L4–5            | 15 days after the surgery, ipsilateral ankle dorsiflexion weakness and recurrent radiating pain | MRI and CT; Ventrolateral EG located at right L5 lateral recess | Conservative treatment (steroid)                                                                          |
| Kaymaz et al. <sup>12)</sup>          | 2005 | NR           | L4–5            | Just after the surgery, contralateral ankle dorsiflexion weakness                               | MRI and CT; Ventromedial and dorsal EG located at L3–4 level    | Conservative treatment (close observation)                                                                |
| Capelle and Krauss <sup>3)</sup>      | 2006 | 50/F         | L5–S1           | 4 days after the surgery, recurrent radiating pain                                              | CT myelography; Ventrolateral EG at L5–S1 level                 | Conservative treatment for 7 days (steroid, analgesics) → Reoperation                                     |
| Ilica et al. <sup>9)</sup>            | 2006 | 44/M         | L4–5            | 5 months after the surgery, lower back pain                                                     | MRI; Ventrolateral EG at L4–5 level                             | Conservative treatment for 1 month → Reoperation                                                          |
| Sasani et al. <sup>18)</sup>          | 2007 | 62/F         | L2–3            | 20 days after the surgery, recurrent radiating pain                                             | MRI; Ventrolateral EG at L2–3 level                             | Conservative treatment (ABR, analgesics)                                                                  |
|                                       |      | 72/F         | L4–5            | 14 days after the discharge, recurrent radiating pain                                           | MRI and CT; Ventrolateral EG at L4–5 level                      | Conservative treatment for 3 days (ABR, analgesics) → CT-guided needle aspiration → Reoperation           |
|                                       |      | 69/M         | L5–S1           | 7 days after the surgery, recurrent radiating pain                                              | CT; Ventrolateral EG at L5–S1 level                             | Conservative treatment for 3 days (ABR, analgesics)                                                       |
| Lee et al. <sup>13)</sup>             | 2014 | 68/F         | L2–3 & L5–S1    | 14 days after the surgery, lower back pain and recurrent radiating pain                         | MRI and CT; Ventral EG at L2–3 & EG (unknown location) at L5–S1 | Conservative treatment (ABR, analgesics, steroid) for 14 days → CT-guided needle aspiration → Reoperation |
| Present article                       | 2020 | 78/F         | L3–4            | 7 days after the surgery, lower back pain and recurrent radiating pain                          | MRI and CT; Dorsal EG at L3–4 level                             | Conservative treatment (ABR, analgesics, steroid) for 7 days → CT-guided needle aspiration #2             |

ABR: absolute bed rest, CT: computed tomography, EG: epidural gas, MRI: magnetic resonance imaging.

epidural space. Also, we could not rule out the possibility of gas inflow to the dorsal epidural space from the surgical wound, especially Hemovac insertion site after surgery or gas inflow through epidural catheter during anesthesia. However, given that the tightly closed wound and re-accumulation of dorsal EG after aspiration, we thought this possibility was unlikely.

CT-guided needle aspiration has been proven effective in studies of spontaneous (non-iatrogenic) spinal EG formation.<sup>5,11)</sup> In 2 previous reports of symptomatic EG after lumbar MD, this method was not the final definitive treatment, as there was gas re-accumulation after the initial aspiration, like with our patient. The problem of gas re-accumulation after aspiration has led to re-operations for symptomatic EG after MD.<sup>13,18)</sup> CT-guided needle aspiration is risky when the EG is located ventromedially. However, if gas is located in the dorsal epidural space (as it was in our patient), this method is relatively safe and simple. For this reason, we repeated this method, without much difficulty, when the gas re-accumulated after the first aspiration. In the eight previous reports of symptomatic EG after lumbar MD, treatment options ranged from conservative treatment to re-operation (**TABLE 1**). Conservative treatments include pain management and restricted bed rest. Restricted bed rest is carried out to prevent additional gas accumulation and promote spontaneous resolution. Conservative treatments were attempted as the first option in all cited reports, but only half of these reported successful recoveries with just conservative management.<sup>12,17,18)</sup> The remaining cases required re-operations.<sup>13,18)</sup>

## CONCLUSION

Symptomatic EG accumulation after lumbar MD is a rare complication. Although re-operation is the most dependable treatment method, CT-guided needle aspiration can be a safe and effective alternative for cases of dorsal EG formation after MD. Avoiding

intervertebral discectomy might reduce the risk of EG accumulation. Moreover, postoperative ambulation should be kept to a minimum after MD, and excessive physical activity should be avoided until the patient is discharged.

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