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# Potential risk of impertinent administration of methylprednisolone in lumbar spine surgery: A case report

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## ABSTRACT

**INTRODUCTION:** Several complications of intravenous administration of Methylprednisolone in spine surgery have been reported previously. However, perioperative Addisonian crisis resulting from postoperative routine cessation of intravenous Methylprednisolone has been rarely reported. We here report a case of perioperative Addisonian crisis induced by postoperative routine cessation of intravenous Methylprednisolone.

**PRESENTATION OF CASE:** To report a 56-year-old lady was diagnosed with Addisonian crisis on postoperative duration of lumbar spine surgery after routine cessation of intravenous Methylprednisolone on postoperative day 5.

**DISCUSSION:** There are potential risk and medical complexity of the intravenous administration of Methylprednisolone perioperatively when patients underwent spine surgery, especially the patients with a history of adrenal insufficiency or hypothyroidism, and other endocrine diseases. The early diagnosis and effective replacement therapy after cessation of intravenous glucocorticoid to keep normal serum hormone levels can reduce risk and complication of Addisonian crisis.

**CONCLUSION:** Addisonian crisis may be triggered by the discontinuation of exogenous glucocorticoid. Physicians need to be immediately aware of this potentially lethal complication in patients with endocrine system diseases.

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## 1. Introduction

Several complications of Methylprednisolone infusion have been reported previously, including hyperglycemia, hyperlipidemia, ischemic necrosis of femoral head, and peptic ulcer, possibly leading to gastrointestinal bleeding [1]. To our knowledge, the complication of Addisonian crisis induced by the routine cessation of intravenous Methylprednisolone has not been reported in open spine surgery for individuals without any adrenal insufficiency. Addisonian crisis usually occurs in the susceptible individuals with adrenal insufficiency, hypopituitarism, and other endocrine diseases [2]. It can be induced by deficiency of aldosterone including mineralocorticoid and glucocorticoid, or by insufficient cortisol response to stress [3]. The major consequences of Addisonian crisis are severe hypotension and shock refractory to the intravenous administration of fluids and vasopressors. We here report a unique case based on the Surgical Case Report (SCARE) guidelines published in 2018, in order to share information of diagnosis and

therapeutic methods of Addisonian crisis occurring perioperatively for spine surgery [4].

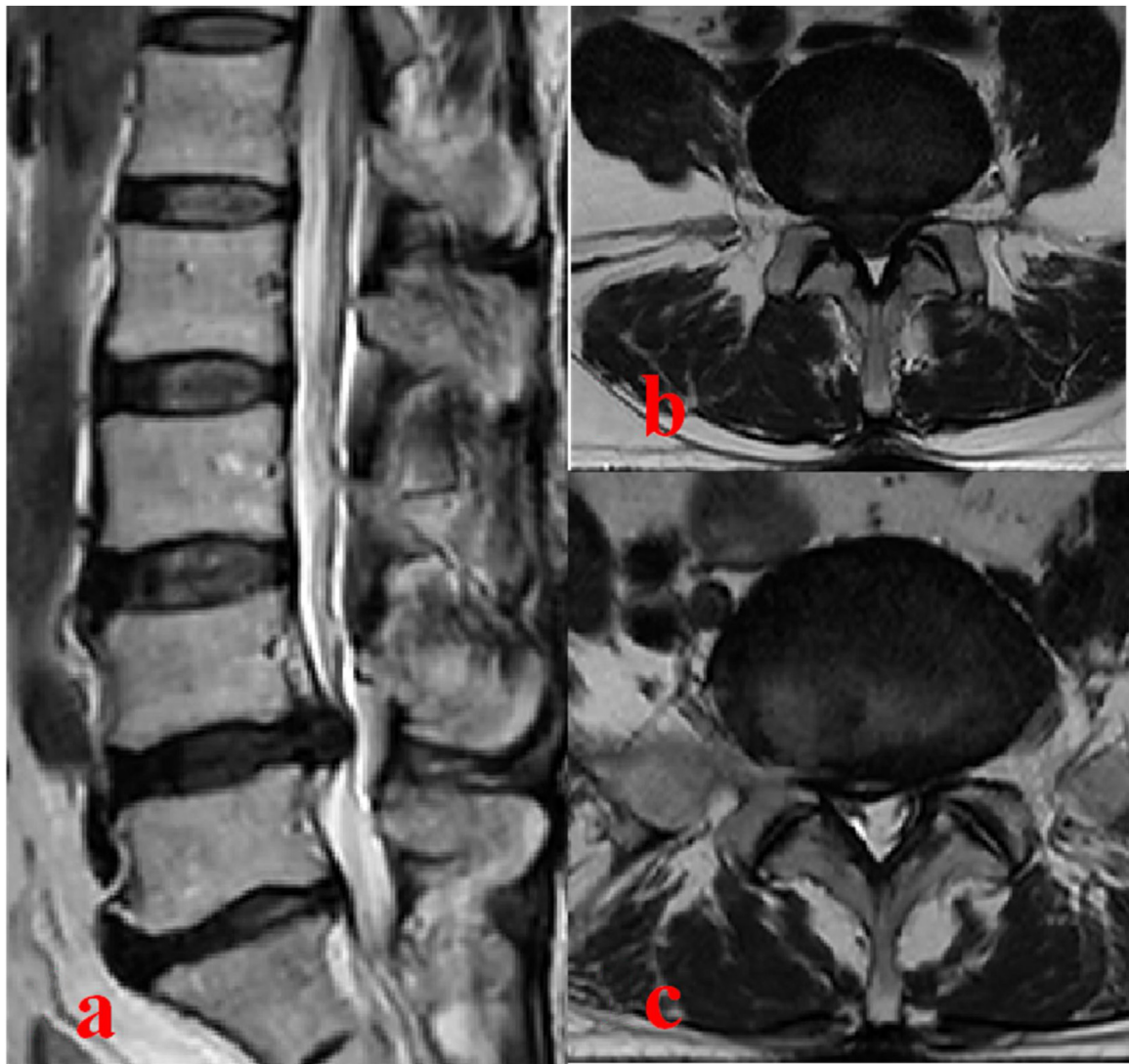
## 2. Case presentation

A 56-year-old woman presented with chronic low back pain and worsened intermittent claudication. Lumbar spine computerized tomography and magnetic resonance imaging demonstrated oblivious lumbar spinal stenosis (Fig. 1a–c).

The patient had hypothyroidism diagnosed 2 years earlier during evaluation for an edema of the face. She had been taking oral levothyroxine regularly until the face edema disappeared one year ago. No abnormalities of serum sodium and potassium levels were detected. The function of thyroid was also normal at follow-up examination. She had no history of other medications and no family history of hypothyroidism.

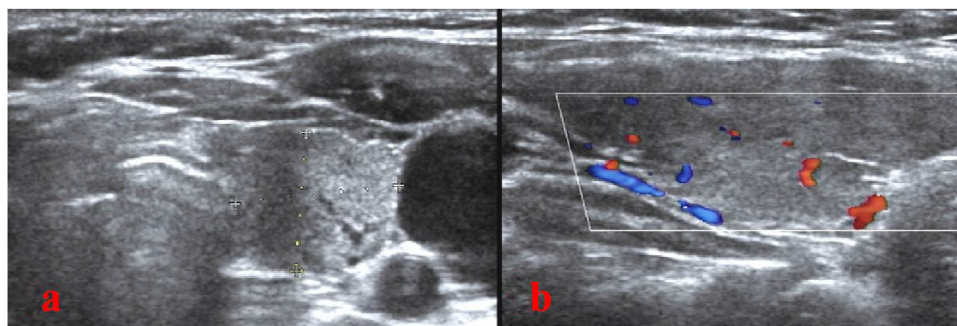
The patient's low back pain and functional disability related to lumbar spinal stenosis did not improve in spite of extensive conservative management including oral non-steroid anti-inflammatory drug therapy and physical therapy. Because of the remote history of hypothyroidism, biochemistry examination and ultrasonography of the thyroid were performed. No abnormalities were found (Fig. 2a, b, and Table 1). Subsequently, she underwent posterior lumbar disc discectomy (L4/5, L5/S1) and spinal canal decompression com-

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**Fig. 1. The Results of MRI for Lumbar Spine.**

The lumbar spine MRI images in this 56-year-old woman. 1a, Sagittal images showed L4/5 disc herniation and spinal stenosis. 1b, 1c, Horizontal images shows serious spinal and bilateral recess stenosis in L4/5 level, and right lateral recess stenosis in L5/S1 level.

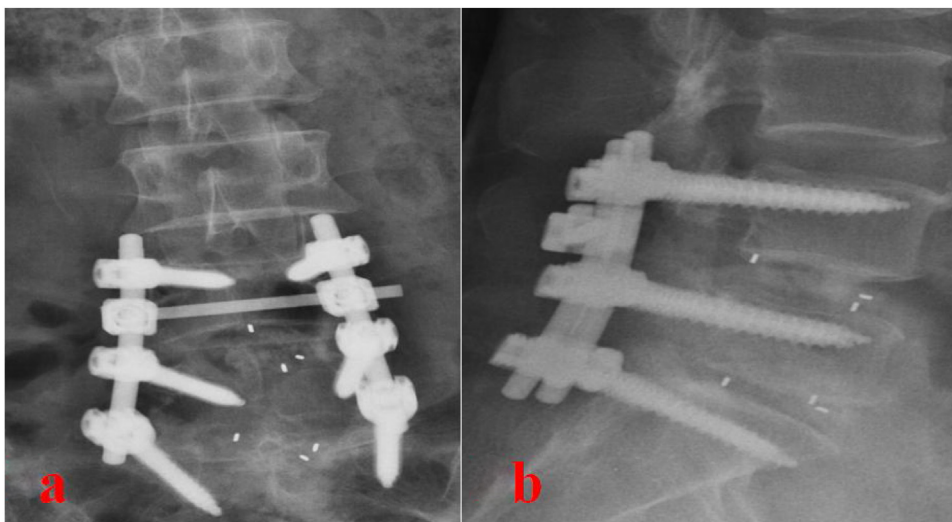


**Fig. 2. The Results of Doppler Ultrasound for Thyroid Gland.**

The thyroid gland ultrasound images in this 56-year-old woman on preoperative time. 2a, and 2b Doppler ultrasound images showed normal-size gland and normal cervical vascular. Besides, ultrasound examination did not find any thyroid nodule.

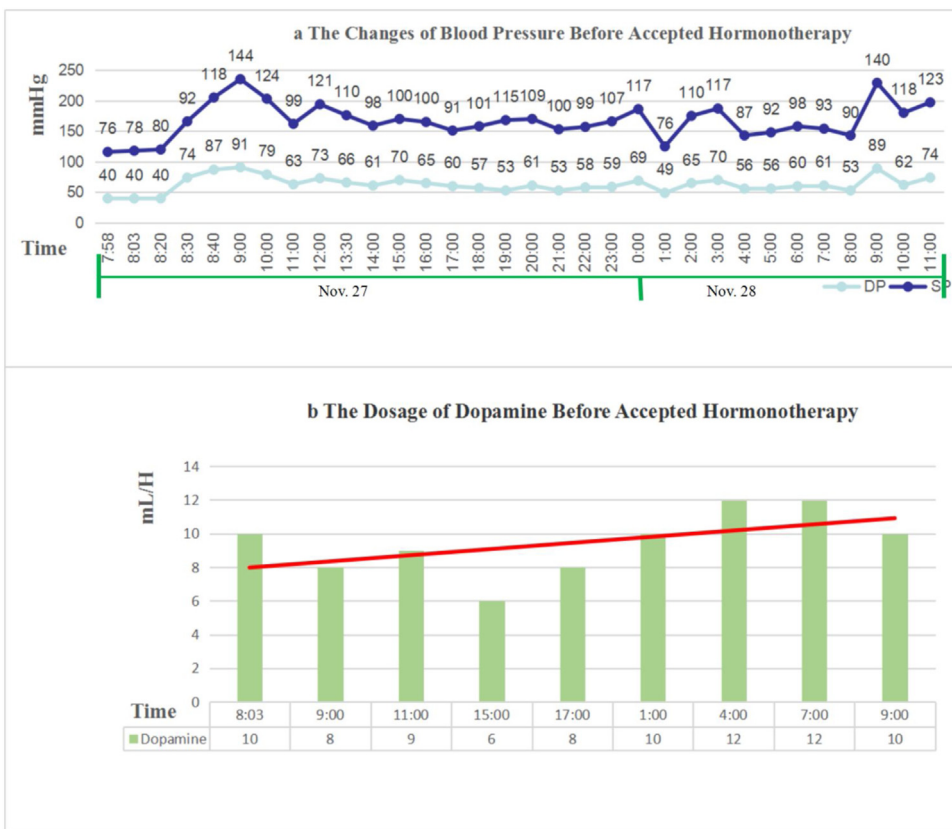
bined with pedicle screw fixation and autogenous bone graft fusion (Fig. 3a, b). This operation was performed by a senior orthopedic surgeon, who had 20 years of specialized surgical experiences. The routine intravenous Methylprednisolone 80 mg per 12 h was used to alleviate postoperative edema of spinal nerve root and for

anti-inflammatory purpose, which was maintained until postoperative day 3. The dose of intravenous Methylprednisolone was then decreased to 40 mg per 12 h. On postoperative day 5, only 40 mg Methylprednisolone was infused intravenously, and then the routine intravenous Methylprednisolone was stopped considering its



**Fig. 3. The Routine Poster-operative X-rays.**

The poster-operative X-rays images in this 56-year-old woman. 3a, and 3b showed posterior lumbar disc discectomy(L4/5, L5/S1) and spinal canal decompression combined with pedicle screw fixation and autogenous bone graft fusion.



**Fig. 4. The Changes of Blood Pressure and Dosage of Dopamine Before Accepted Hormonotherapy.**

Fig. 4a and b showed unstable blood pressure before accepted intravenous hydrocortisone, even if a large amount of dopamine were used.

**Illustration:** DP: Diastolic Blood Pressure, SP: Systolic Pressure. Red Line in Fig. 4b showed the trend of dosage of Dopamine.

potential side effects. However, the patient suddenly developed shock, hypotension, emesis, nausea, arrhythmia, transient coma, and multi-systematic clinical symptoms in the second day. The profound hypotension was unresponsive to intravenous fluids, and a large doses of vasopressors were required (Fig. 4a, b).

Biochemical examinations including blood sugar, Ttriiodothyronine (TT<sub>3</sub>), Thyroxine (TT<sub>4</sub>), Free Thyroxine (FT<sub>4</sub>), Free Triiodothy-

ronine (FT<sub>3</sub>), Thyroid Stimulating Hormone (TSH), Adrenal Cortical Hormone (ACH), Adrenocorticotrophic Hormone (ACTH) and radiographic examination were performed timely or regularly (Fig. 5a–d, Tables 1 and 2).

After multidisciplinary consultation, hydrocortisone 100 mg combined with 0.9% saline per 6 h was given intravenously. The blood pressure gradually recovered and maintained at the normal



**Fig. 5. The CT Images of Pituitarium and Paranephros on Poster-operative Time.**

**Illustration:** The routine poster-operative CT images in this 56-year-old woman. Fig. 5a and b showed the normal pituitary body without any tissue neoplasm and bone destruction. Fig. 5c and d showed the normal morphology bilateral paranephros.

**Table 1**  
The Levels of Thyroid Related Hormones on Perioperative duration.

Types	Nov. 20	Nov. 22	Nov. 27	Dec. 3	Normal Range
<b>T3</b>	1.47	1.05	0.84	0.39	0.56–1.47
<b>T4</b>	100.5	110.8	100.7	69	39.0–105.0
<b>FT3</b>	3.36	2.41	2.21	1.34	2.40–4.50
<b>FT4</b>	1.08	1.28	1.63	1	0.90–1.66
<b>TSH3UL</b>	2.431	0.541	3.962	0.495	0.55–4.78

The values of thyroid related hormones in this 56-year-old woman on perioperative duration. The normal level of thyroid related hormones on preoperative time. There were no abnormal changes on Nov. 22 and Dec. 3.

level without any vasopressors and intravenous fluids (Fig. 6a–d). The intravenous infusion of hydrocortisone was reduced and shifted to oral medications when symptoms were alleviated, and stopped in 1–3 months. Following administration of this therapy, the patient recovered and did not experience any further episode of hypotension or apychnia.

**3. Discussion**

This case exemplifies the potential risk and medical complexity of the intravenous administration of Methylprednisolone perioperatively when patients underwent spine surgery, especially the

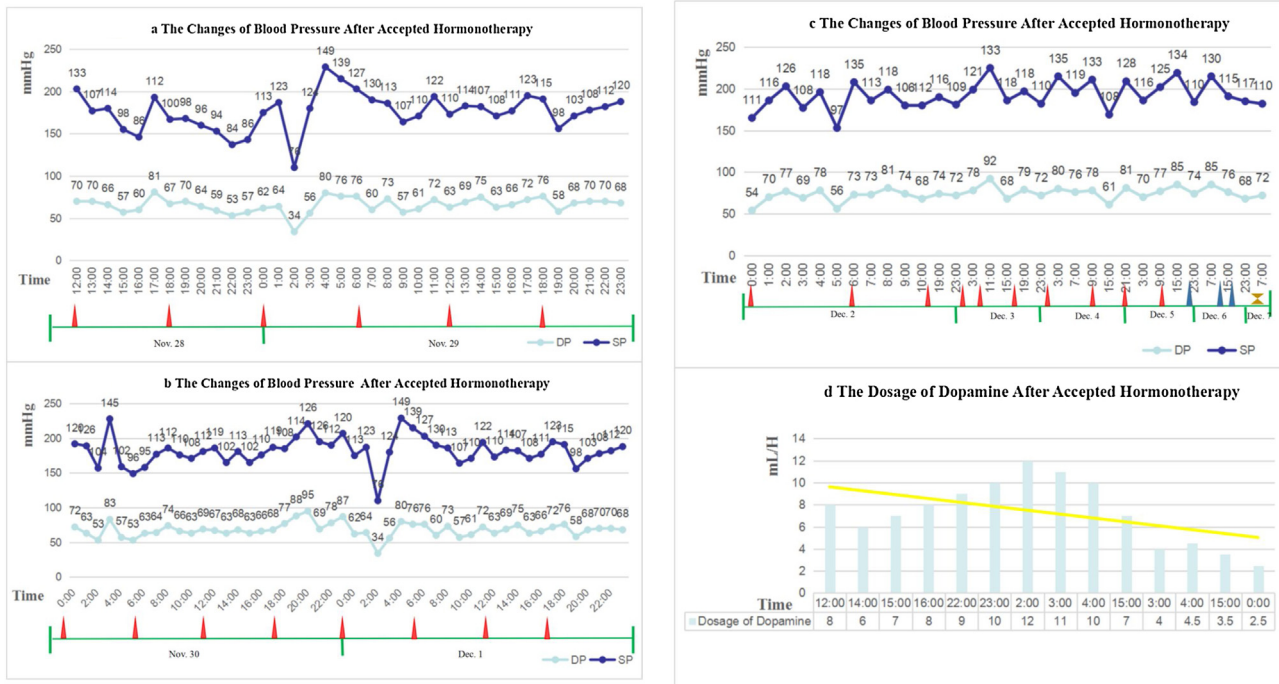
patients with a history of adrenal insufficiency or hypothyroidism, and other endocrine diseases. Thus, this case report suggests that underlying endocrine disease may be a potential cause of perioperative multi-systematic symptoms such as hemodynamic decompensation, digestive and neurological symptoms, which cannot be explained with a single system disease.

Adrenal disease or secondarily adrenocorticotrophic hormone (ACTH) deficiency related to pituitary or hypothalamic disorders may result in adrenal insufficiency [2,3]. The characteristics of Addison disease include deficiency of cortisol, glucocorticoid, mineralocorticoid and aldosterone, which are always accompanied with elevation of ACTH [3]. Epidemiological data have shown that the prevalence is only 4–11 cases per 100,000 population, however, frequent morbidity and mortality related to this disease has been reported [5]. In addition, it is difficult to establish a quick diagnosis for this potentially lethal disorder due to nonspecific signs and symptoms in its early stages. A series of symptoms include generalized weakness, fatigue, anorexia, nausea, vomiting, abdominal pain, fever, and hypotension with refractory blood pressure, which always involve multiple systems or organs [6]. Thus, spine surgeons should pay more attention to administration of intravenous Methylprednisolone during the perioperative period because of routine usage of glucocorticoid for inhibiting or relieving the edema or inflammation of spinal nerve root [1,7]. Importantly, the detailed

**Table 2**  
The Levels of Cortisol and Corticotropin Function on Perioperative duration.

Type	Nov. 27 8:00 am	Nov. 27 8:00 pm	Nov. 28 0:00 am	Dec. 3 0:00 am	Dec. 3 8:00 am	Dec. 3 4:00 pm	Normal Range
<b>Cortisol (noml/L)</b>	1439.23	313.35	262.32	604.68	500.38	1353.53	8:00 am–9:00 am:160–718 4:00 pm:110–360
<b>Corticotropin (pmol/L)</b>	171	No Detected	3.77	No Detected	<0.220	No Detected	1.6–13.9

The values of thyroid related hormones in this 56-year-old woman on perioperative duration. The normal level of thyroid related hormones on preoperative time. There were no abnormal changes on Nov. 22 and Dec. 3.



**Fig. 6. The Changes of Blood Pressure and Dosage of Dopamine After Accepted Hormonotherapy.** Fig. 6a–d showed unstable blood pressure before accepted intravenous hydrocortisone, even if a large amount of dopamine were used. **Illustration:** DP: Diastolic Blood Pressure, SP: Systolic Pressure. Red Triangle in Fig. 6a–c expressed that intravenous usage of 100 mg hydrocortisone. Blue Triangle in Fig. 6c expressed that intravenous usage of 50 mg hydrocortisone. Double brown Triangles showed Oral hydrocortisone on Dec. 7. Yellow Line in Fig. 6d showed the trend of dosage of Dopamine.

examinations and specialist consultation need to be completed before surgery, when a patient has a history of endocrine diseases.

Many factors such as surgery, hypoglycemia, fever, and other factors, may result in Addisonian crisis in the context of aldosterone deficiency and insufficient cortisol [8]. In our case, the stress associated with surgery or long-term sitting was sufficient to induce Addisonian crisis. The most concerning consequences of Addisonian crisis are severe hypotension and transient syncope as seen in this case. Exacerbation of symptoms had been seen until she received maintenance therapy of corticosteroids. Besides, syncope and vomiting did not occur again after maintenance therapy of intravenous glucocorticoid in this crisis. Lastly, the patient's blood pressure was responsive to intravenous dopamine and fluids, and restored gradually even if intravenous fluids and vasopressors were discontinued.

It is intensely cautious to cease routine intravenous glucocorticoid for patients with adrenal insufficiency or hypothyroidism, and other endocrine diseases. We suggest oral replacement therapy after cease of intravenous glucocorticoid to keep normal serum hormone levels which can show benefit of avoiding to presentation with Addisonian crisis. In this case, hypotension occurred suddenly after stopping intravenous glucocorticoid.

**4. Conclusion**

It is important for physicians to be aware of Addisonian crisis in patients presenting with refractory hypotension, sudden shock or multi-systematic symptoms, in particular, in the individuals who have a history of endocrine diseases such as adrenal insufficiency or hypothyroidism. The single routine administration of fluids and vasopressors for hypotension and secondary shock is inadequate to raise blood pressure in patients who present with Addisonian crisis. In fact, additional intravenous infusion of hormone should be given as soon as possible. Besides preoperative expert consultation, physicians must recognize the patient's condition immediately.

Last but not least, intravenous hydrocortisone should be administered timely to resolve the crisis given the emergent nature of this complication.

**Declaration of Competing Interest**

The authors report no declarations of interest.

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**Ethical approval**

The paper is a case report, and therefore does not require ethics approval.

**Consent**

All privacy of our patient are not showed in our paper.

**Author contribution**

**Dan Pu:** Conceptualization; **Lunli Xie:** Data curation and Writing - original draft; **Xudong Chen, and Zhenlin Yan:** Investigation; **Changyuan Yang:** Methodology; **Jun Zhu:** Writing - review, and Funding acquisition.

**Registration of research studies**

This is a retrospective case report but not for clinical trial, and this case without wrongdoing.

**Guarantor**

The guarantor of this article is Dr. Dan Pu.

**Provenance and peer review**

Not commissioned, externally peer-reviewed.

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