

**Figure 1.** Pre- and postoperative X-ray images.

An adult spinal deformity was observed preoperatively (a, anterior-posterior projection; b, lateral projection). The spinal deformity was corrected with lateral interbody fusion and percutaneous pedicle screws from T10 to the iliac spine (c: anterior-posterior projection, d: lateral projection). The percutaneous pedicle screws were placed within the pedicles except for the left T12 screw (red circle) (g) (e-m: axial computed tomography images).

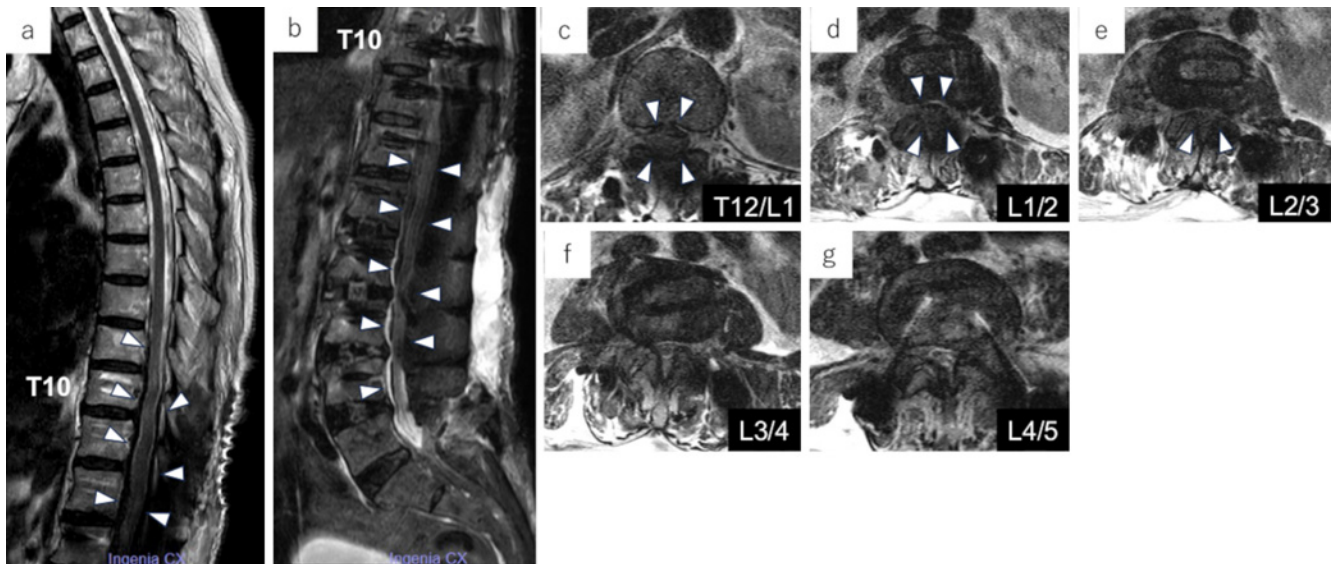
**Table 1.** Radiological Parameters Related to Adult Spinal Deformity.

|                                  | Preoperative | Postoperative |
|----------------------------------|--------------|---------------|
| Cobb angle between T11 and L4    | 48°          | 17°           |
| Lumbar lordosis                  | 9°           | 55°           |
| Pelvic tilt                      | 40°          | 20°           |
| Pelvic incidence–Lumbar lordosis | 50°          | 4°            |
| Sagittal vertical axis           | 66 mm        | 13 mm         |

scribed sSAH following cMIS using LIF and PPSs fixation for ASD<sup>4,6</sup>. Reduced subarachnoid pressure related to cerebrospinal fluid leakage may result in sSAH<sup>3</sup>, however, dural tears or cerebrospinal fluid leakage were not observed intraoperatively in our case. Therefore, we believe that the surgical procedure did not directly result in postoperative sSAH. Our patient did not take any antithrombotic drugs and had no apparent underlying disease responsible for postoperative sSAH. No hemorrhagic origin was identified in the second surgery, and the sSAH did not recur. Therefore, overlooked or unidentified preoperative vascular lesions were not observed in this patient.

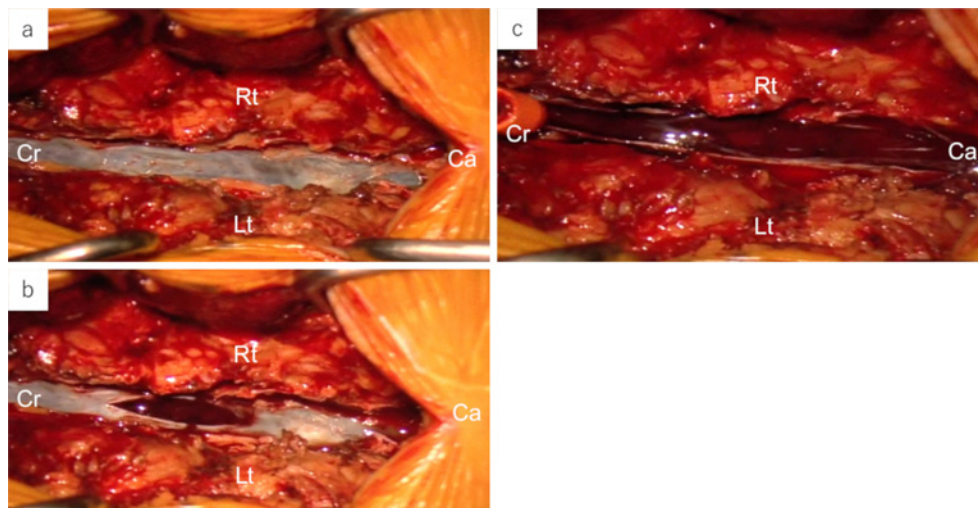
The following theory has been postulated as a mechanism of sSAH: minor trauma can increase the intrathoracic, intraabdominal, and intraluminal pressures of the spinal vessels, especially the valveless radiculomedullary veins traversing the subarachnoid space. If cerebrospinal fluid fails to neutralize the increased pressure, spinal vessel rupturing can lead to sSAH<sup>7</sup>. In our case, the stress on the intraabdominal pressure when scoliosis was intraoperatively corrected following cMIS using LIF and PPS fixation could have resulted in a minor tear of the radiculomedullary veins and sSAH. Traction related to spinal correction may also have resulted in increased intravenous pressure. As the postoperative symptoms related to sSAH appeared 2 days after the first surgery, it seems coherent that persistent bleeding from a minor tear of the radiculomedullary veins formed the sSAH. Tension of the spinal cord and nerve roots after correction surgery could also have resulted in venous rupture and sSAH formation.

Because the left T12 PPS violated the medial wall of the pedicle, this could have also resulted in sSAH<sup>8</sup>. However, as there have been no similar reported cases, further research is warranted to clarify the pathology of sSAH after cMIS using LIF and PPS fixation for ASD.



**Figure 2.** Magnetic resonance images after the first operation.

T2-weighted magnetic resonance images revealed multiple hypointense ventral and dorsal lesions (white arrowheads). These findings indicate hematoma (a and b: sagittal images; c-g: axial images).



**Figure 3.** Intraoperative findings.

The exposed dura was reddish (a). The subarachnoid hemorrhage spilled after the subarachnoid membrane was incised (b). A subarachnoid hemorrhage is longitudinally identified (c) (Ca, caudal; Cr, cranial; Lt, left; and Rt, right).

**Conflicts of Interest:** The authors declare that there are no relevant conflicts of interest.

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**Author Contributions:** Tomohisa Harada, Yoshinori Maki, and Satoshi Makio designed the study; Tomohisa Harada performed surgery; Yoshinori Maki wrote the first manuscript; and Tomohisa Harada revised the manuscript critically. Kenji Takahashi supervised the study and approved the final version of the manuscript.

**Ethical Approval:** This study was approved by the ethical committee of Rakuwakai Marutamachi Hospital (approval number 2019-2).

**Informed Consent:** Informed consent was obtained from the patient prior to publication of this study.

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