Clinical Case Report

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Progression of aggressive vertebral hemangiomas during pregnancy

Three case reports and literature review

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Abstract

Rationale: Vertebral hemangiomas (VHs), one of the most common benign tumors of the spine, can be aggressive, which is a rare condition and causes neurological deficits. Pregnancy is related to the worsening of aggressive VHs. The diagnosis and treatment of aggressive VHs remain challenging, especially for pregnant cases.

Patient concerns: We report 3 cases of aggressive VH in women who developed progressive neurological deficits during pregnancy among 95 patients treated for aggressive VH in our hospital in the past 15 years.

Diagnoses and Interventions: All 3 patients experienced progressive deterioration of neurological function and pain at 13, 28, and 41 weeks' gestation. On radiological examination, VHs were the suspected radiological diagnoses in 2 patients; 1 patient was preoperatively misdiagnosed with a spinal metastatic tumor. All 3 patients underwent decompression surgery with intraoperative vertebroplasty and/or postoperative radiotherapy. The pathological diagnosis after surgery was all hemangiomas.

Outcomes: In all 3 patients, there were no tumor recurrences, and neurological functions remained normal at the last follow-up of 75, 38, and 15 months after the treatment, respectively.

Lessons: Pregnancy might lead to the onset of aggressive VHs. The diagnosis and treatment of VHs during pregnancy remain controversial due to concern for both maternal and fetal safety. Timely surgery could preserve neurological function. Decompression surgery by laminectomy followed by adjuvant therapies require less skill and have a shorter surgery time, and can be considered more appropriate for aggressive VHs with pregnancy.

Abbreviations: CA = cancer antigen, CT = computed tomography, MRI = magnetic resonance imaging, PET = positron emission tomography, VAS = visual analog score, VH = vertebral hemangioma.

Keywords: aggressive vertebral hemangiomas, decompression surgery, pregnancy, progression

1. Introduction

Vertebral hemangiomas (VHs), one of the most common benign spinal tumors, are vascular malformations that comprise rich blood vessels.[1,2] Frequently affecting the thoracic spinal columns, the incidence of VHs is 10% to 26%. The majority of VHs are asymptomatic, and only 0.9% –1.2% of patients develop symptoms.[1–4] In addition to pain, some VHs may be aggressive (Enneking Stage 3[5]), extending into the spinal canal and paravertebral space to cause spinal cord compression and neurological deficit.[1,3,6,7]

Pregnancy results in increased blood volume and hormone changes, which may lead to the worsening of aggressive VHs.[8–14] Although aggressive VH during pregnancy is a rare condition, its diagnosis and treatment remain challenges because both maternal neurological functions and fetal safety must be considered.[15] There are a few case reports in the literature that discuss the treatment of aggressive VHs during pregnancy; however, most are sporadic case reports, and the treatment remains controversial.[8–12,14–32]

Our hospital has treated 95 patients with aggressive VHs in the past 15 years, including 3 with progressive neurological deficits that developed during their pregnancies. Here, we report our experience of aggressive VHs during pregnancy and the results of a literature review of articles published in the past 30 years. The study was approved by the ethics committee of Peking University Third Hospital. Informed consents for publication of the case details were obtained from the reported patients.

2. Case reports

2.1. Case 1

A 27-year-old woman in her 13th week of gestation was referred to our department for progressive numbness of her right arm and

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Ethical approval: The study was approved by the ethics committee of Peking University Third Hospital. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consents for publication of the case details were obtained from the reported patients.

The manuscript submitted does not contain information about medical device(s) or drug(s).

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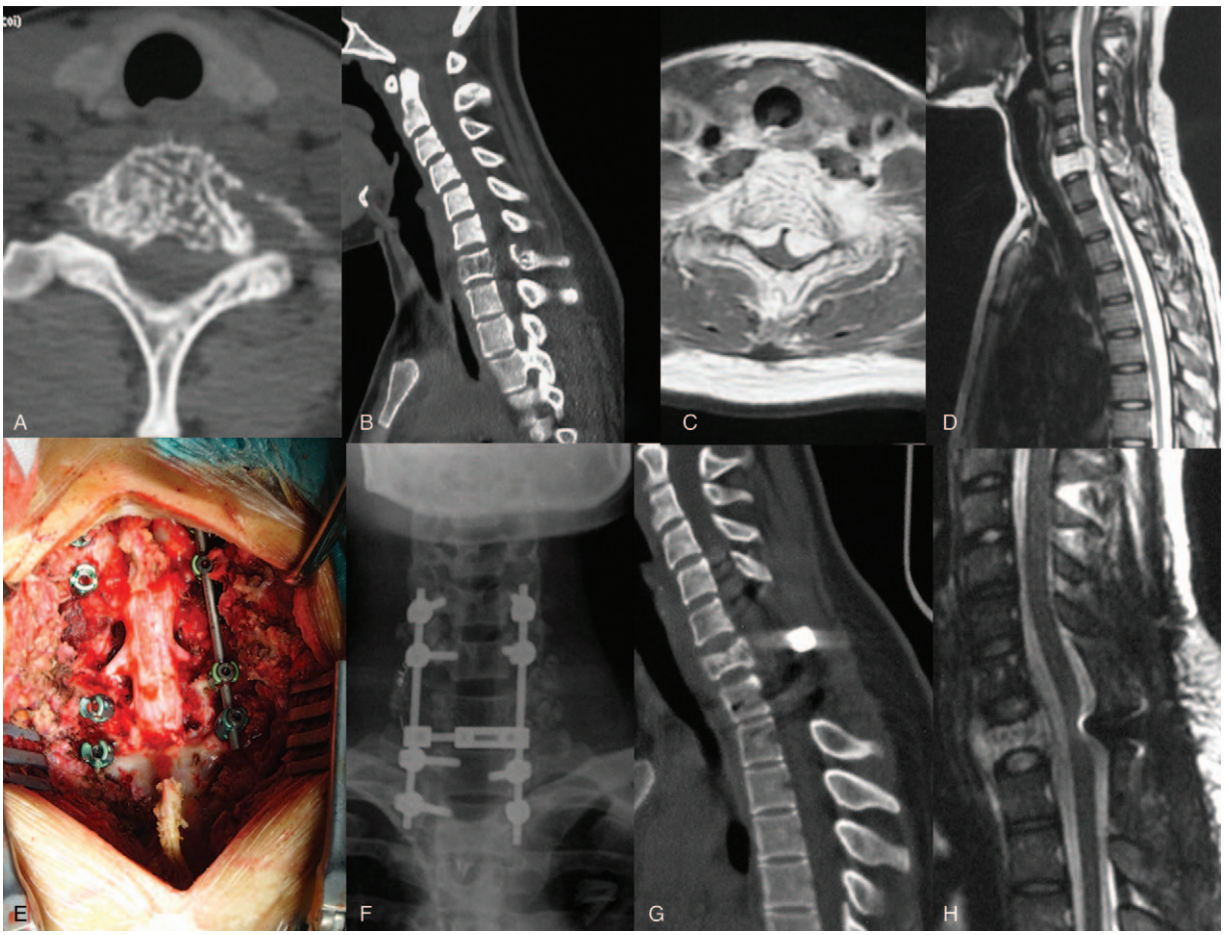

Figure 1. A 27-year-old woman at 13 weeks of gestation with progressive neurological deficit and neck pain. (A and B). Axial and sagittal CT scans reveal an osteolytic lesion in the vertebral body and right lamina of C7. The lesion shows a polka-dot appearance and vertical striations on CT. (C and D). Axial and sagittal MRI revealing epidural compression. The lesion extends into the spinal canal and paraspinal space. The patient underwent decompression surgery after embolization. (E) Intraoperative picture. (F–H). Plain radiography, sagittal CT, and MRI before radiotherapy. CT = computed tomography, MRI = magnetic resonance imaging.

paralysis and numbness of her bilateral lower extremities for 3 weeks. She also complained of neck pain, and her visual analog score (VAS) was 4/10. She was otherwise healthy previously. She had sensory deficits below the level of her xiphoid, and the muscle strength of her lower limbs was 2/5 (modified Frankel grade C). Radiological imaging revealed a C7 lesion and VH was the suspected radiological diagnosis. Preoperative embolization was performed to reduce intraoperative blood loss, followed by laminectomy, intraoperative injection of ethanol, and postero-lateral fusion.[33] The estimated blood loss was 1200 mL. The pathological report after surgery revealed a hemangioma. Her pregnancy was later terminated; she underwent radiotherapy. At 75 months follow-up, there was no sign of recurrence; she was the mother of a 3-year-old boy and free of neurological symptoms (Fig. 1).

2.2. Case 2

A previously healthy 29-year-old woman in the 28th week of her gestation experienced intermittent back pain (4/10 by VAS) that was relieved with rest. At week 39 of her gestation, her pain suddenly worsened (9/10 by VAS), with weakness and numbness of her lower limbs. She could only walk with assistance. After delivery of a healthy baby, the muscle strength of her lower limbs was 0/5 with bowel and bladder dysfunction (modified Frankel B). Emergency magnetic resonance imaging (MRI) and computed tomography (CT) revealed bony destruction and pathological fracture at T7 (Fig. 2), suggestive of malignancy. Her blood tests revealed cancer antigen (CA)-125 (82.45 U/mL) and 15–3 (30.5 IU/mL) levels above the normal ranges. Positron emission tomography (PET-CT) was performed, revealing a suspected malignant mass in her right breast in addition to the tumor on T7. She underwent separation surgery[34] for suspected spinal metastasis tumor with intraoperative radiofrequency ablation and vertebroplasty. The estimated blood loss was 1200 mL. The pathological diagnosis was a hemangioma. No mass was detected in her right breast by ultrasound in her follow-up after surgery. She underwent adjuvant radiotherapy 3 months after surgery. At 38 months follow-up, there was no sign of recurrence on the spine and her neurological function was Frankel D3 (slight weakness but normal function) (Fig. 2).

2.3. Case 3

After a normal uneventful 40-week gestation and delivery, a 35-year-old woman experienced sharp back pain (8/10 by VAS) the day after delivery, which was not relieved by rest or analgesics. She had progressive numbness and weakness in the bilateral

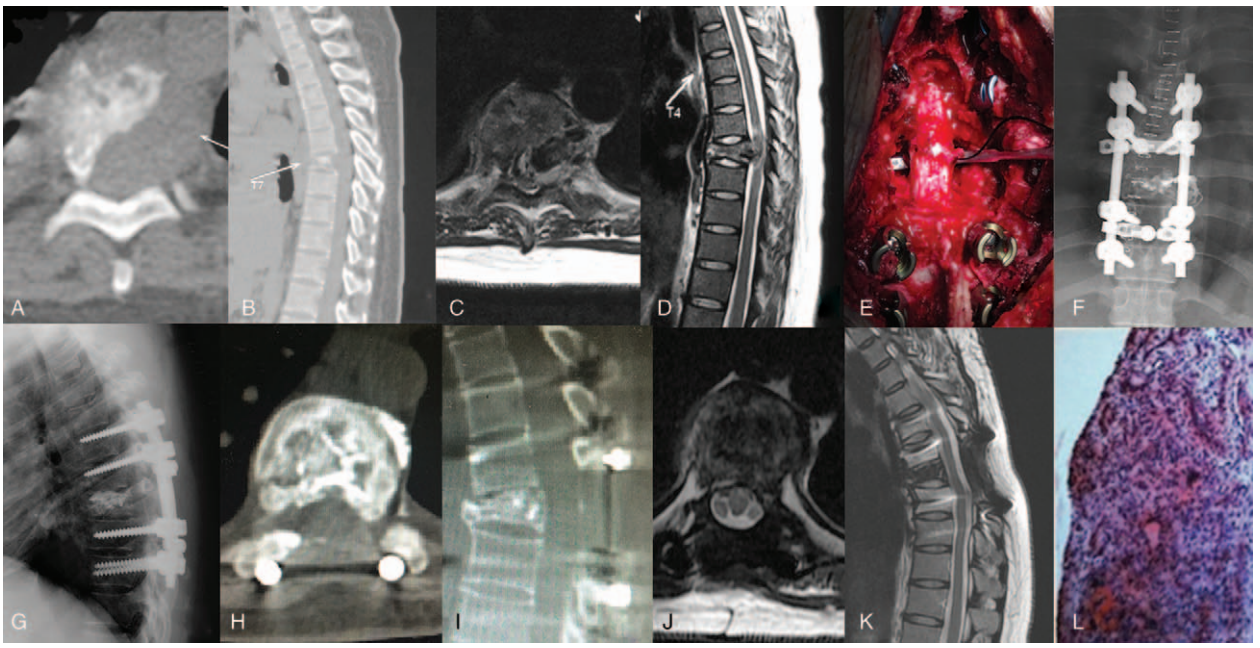

Figure 2. A 29-year-old woman at 28 weeks of gestation with intermittent back pain. At the 39th week of gestation, she developed progressive neurological deficit and worsened pain. (A and B) Axial and sagittal CT scan of an osteolytic lesion and fracture in the vertebral body of T7. (C and D) Axial and sagittal MRI revealing epidural compression. (E–G) The patient underwent decompression surgery with intraoperative vertebroplasty. (H–K) CT and MRI at 36 months after surgery. (L) Pathology after surgery was a hemangioma (Hematoxylin and eosin, 10 × 10). CT = computed tomography, MRI = magnetic resonance imaging.

extremities. On the 20th day after delivery, she could not stand up and had bowel and bladder dysfunction; thus, she was referred to our hospital. She had sensory reduction below the level of T6, and the muscle strength of her lower extremities was 3/5 (modified Frankel D2). MRI and CT revealed a pathological vertebral fracture of T5. VH was the suspected radiological diagnosis. She underwent decompression and fixation with intraoperative vertebroplasty. The estimated blood loss was 300 mL and the pathological diagnosis was a hemangioma. At 15 months follow-up, she had no neurological deficits and was without recurrence (Fig. 3).

2.4. A summary of the published literature

Aggressive VHs during pregnancy are rare; therefore, for better evaluation, we performed a brief review of the management of

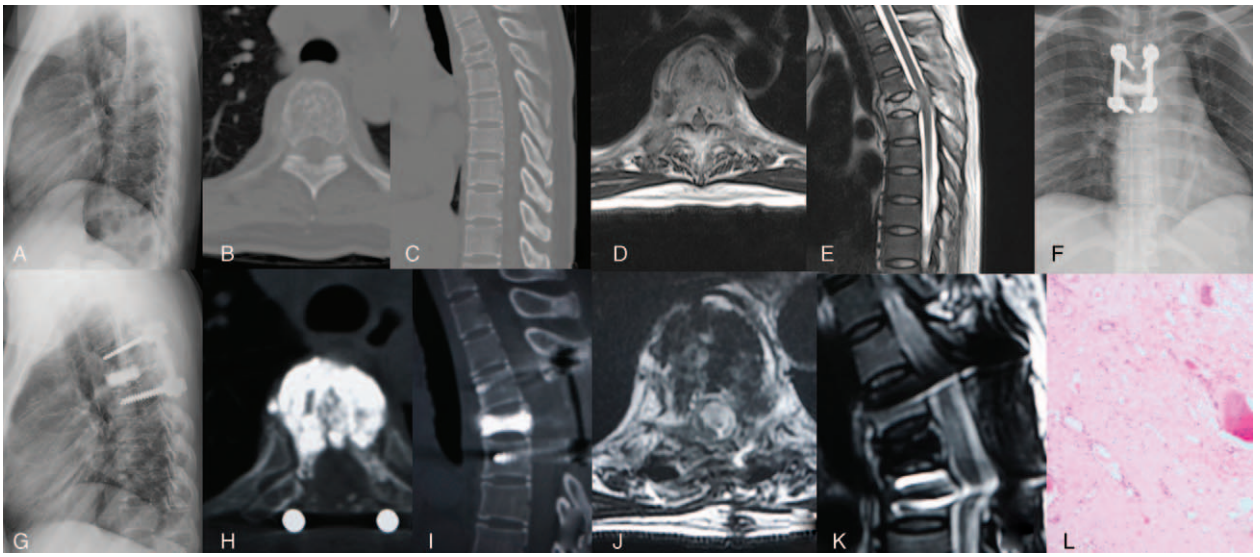

Figure 3. A 35-year-old woman developed progressive neurological deficit and severe pain the day after delivery. (A) Preoperative lateral radiography. (B and C). Axial and sagittal CT scan showing an osteolytic lesion with a T5 fracture. (D and E). Axial and sagittal MRI showing a lesion in the vertebral body and lamina with epidural extension. She underwent decompression and fixation with intraoperative vertebroplasty. (F and G). Postoperative anteroposterior and lateral radiography. (H–K) CT and MRI 12 months after surgery. (L) The pathological diagnosis was a hemangioma (Hematoxylin and eosin, 4 × 10). CT = computed tomography, MRI = magnetic resonance imaging.

Table 1

A summary of cases with aggressive vertebral hemangiomas during pregnancy.

Authors (year of publication)	Age	Weeks of gestation	Symptoms	Locations	Treatment	Fetal outcome	Follow-up, months	Maternal outcome
Lavi et al[30] (1986)	25	31	Paraplegia	T4	Laminectomy (antepartum)	Alive	Not mentioned	Complete relief
	21	35	Paraparesis	T2	Laminectomy (postpartum)	Alive	Not mentioned	Complete relief
Liu et al[8] (1988)	25	22	Paraplegia	T4	Resection with rib grafts (antepartum)	Alive	21	Complete relief
Schwartz et al[10] (1989)	30	30	Paraplegia	T5	Laminectomy (antepartum, second surgery postpartum due to symptom recurrence)	Alive	2	Complete relief
Redekop et al[16] (1992)	20	34	Paraparesis	T12	Corpectomy (postpartum)	Alive	9	Partial relief
Tekkok et al[17] (1993)	25	35	Paraplegia	T5	Laminectomy (postpartum)	Alive	3	Complete relief
Abi-Fadel et al[18] (1997)	28	34	Paraplegia	T9	Laminectomy and adjuvant radiotherapy (postpartum)	Alive	Not mentioned	Complete relief
Castel et al[32] (1999)	27	28	Paraplegia	T8	Laminectomy (postpartum)	Alive	Not mentioned	Complete relief
Schwartz et al[31] (2000)	29	41 (postpartum)	Paraplegia	T11	Corpectomy and adjuvant radiotherapy (postpartum)	Alive	8	Complete relief
Chi et al[19] (2005)	26	24	Paraparesis	C7	Corpectomy (antepartum)	Alive	4	Complete relief
Inamasu et al[20] (2006)	20	33	Cauda equina syndrome	L2	Laminectomy, foraminotomy and vertebroplasty (postpartum)	Alive	6	Complete relief
Yuksel et al[21] (2007)	21	21	Paraplegia	T9	Laminectomy (postpartum)	Alive	Not mentioned	Complete relief
Vijay et al[14] (2008)	22	26	Paraplegia	T11	Laminectomy with embolization (antepartum) Corpectomy with embloization (postpartum)	Alive	28	Complete relief
Kiroglu et al[22] (2009)	22	36	Paraplegia	T4	Embolization (postpartum), vertebroplasty 2 years later	Alive	6	Complete relief
Blecher et al[26] (2010)	35	35	Radiculopathy	L4	Laminectomy and vertebroplasty (postpartum)	Alive	12	Complete relief
Saeed et al[24] (2010)	27	30	Paraparesis	T3-5	Laminectomy (postpartum)	Alive	Not mentioned	Complete relief
Shinozaki et al[25] (2010)	27	31	Paraplegia	T2	laminectomy (postpartum), embolization and corpectomy the second time	Alive	24	Complete relief
Jankowski et al[27] (2012)	27	34	Paraparesis	T6	thoracotomy (postpartum)	Alive	Not mentioned	Partial relief
Gupta et al[28] (2014)	23	28	Paraplegia	T3-5	Laminectomy (postpartum)	Alive	3	Partial relief
Moles et al[9] (2014)	28	35	Paraparesis	T3	Laminectomy (postpartum), vertebroplasty 9 months later	Alive	18	Complete relief
	35	36	Radiculopathy	T7	Laminectomy (postpartum)	Alive	21	Complete relief
Slimani et al[12] (2014)	19	38	Paraplegia	T4	Corpectomy (antepartum)	Alive	3	Complete relief
Elmadag et al[11] (2015)	35	32	Paraparesis and superior mesenteric artery syndrome	L3	Laminectomy (postpartum)	Alive	12	Partial relief
Meng et al[15] (2015)	28	The second trimester	Paraparesis	T3	Complete posterior tumor resection (postpartum)	Alive	63	Alive, neurological function not mentioned
	29	The second trimester	Paraparesis	T6	Complete posterior tumor resection (postpartum)	Alive	46	Alive, neurological function not mentioned
	28	The second trimester	Paraplegia	T7	Complete posterior tumor resection (postpartum)	Alive	43	Alive, neurological function not mentioned
	30	The second trimester	Paraparesis	L1, L3	Complete posterior tumor resection (postpartum)	Alive	32	Alive, neurological function not mentioned
	32	The third trimester	Paraparesis	T4	En bloc spondyectomy (postpartum)	Alive	24	Alive, neurological function not mentioned
Staikou et al[29] (2015)	32	41 (postpartum)	Severe pain due to fracutre	L2	Posterior stablization	Alive	6	Complete relief
Present case 1	27	13	Paraparesis	C7	Laminectomy and intraoperative vertebral injection of alcohol (antepartum)	Abortion	75	Complete relief
Present case 2	29	28	Paraplegia	T7	Laminectomy, radiofrequency ablation and intraoperative vertebroplasty (postpartum)	Alive	38	Partial relief
Present case 3	35	41 (postpartum)	Paraparesis	T5	Laminectomy and intraoperative vertebroplasty (postpartum)	Alive	15	Complete relief

VHs during pregnancy in the PubMed, EBSCO, OVID, and Springer databases. Our search criteria included aggressive VH, pregnancy, treatment, and publication in recent years. The reference list of each article was reviewed to identify additional cases. The inclusion criteria were cases with a specific diagnosis of hemangioma with aggressive features (Enneking Stage 3, spinal cord compression, and neurological deficits) during pregnancy. Epidural hemangiomas without vertebral body involvement, hemangiomas without symptoms, and cases with incomplete data were excluded (Table 1).[8–12,14–32]

A total of 32 cases (including the present cases) were identified in literature published in the past 30 years. The average age at diagnosis was 27.1 years (range, 19–35). The symptoms started in the first trimester of gestation in one (3.1%) case, the second trimester in 8 (25.0%), the third trimester in 20 (62.5%) and shortly after delivery in 3 (9.4%) cases. The location of the aggressive VHs was the cervical spine in 2 (both in C7) cases, thoracic spine in 25 (16 of 25 in the upper thoracic spine, 64%) and the lumbar spine in 5 cases.

3. Discussion

This report described in detail 3 rare cases of aggressive VHs during pregnancy. We also summarized a total of 32 cases published in the past 30 years (including the present cases).

Pregnancy plays an important role in the pathogenic mechanisms of VHs in 2 main ways.[8–14] Increased blood volume during pregnancy, especially in the third trimester (which may explain why 62.5% of cases were in the third trimester). After delivery, uterine contractions may lead to a rapid volume increase and fast progression of aggressive VHs (2/32, 6.3%). Pregnancy changes levels of hormones, such as estrogen and progesterone, which may lead to VH angiogenesis and growth.

The diagnosis and treatment of aggressive VHs during pregnancy is controversial due to considerations for both maternal and fetal safety.[15] Typical VH lesions have vertical trabeculation and a honeycomb appearance on CT and a salt-and-pepper appearance on MRI. MRI is usually performed first for pregnant patients. CT should be used with caution due to the potential radiation harm to the fetus,[15] although CT is valuable. For patients with atypical imaging feature, percutaneous CT-guide biopsy may be helpful.[35] However, cautious consideration by both the doctors and patients are necessary due to the potential radiation harm of CT. Moreover, for patients with rapidly progressing VHs, timely decompression prior to CT-guided biopsy may save neurological function.

Surgery is usually recommended for the treatment of aggressive VHs.[3,6,7,36] Timely surgery may save neurological function. Most of the reviewed cases achieved excellent symptom relief by surgical treatment.[8–12,14–31] However, surgery and indications should undergo careful evaluation and be fully discussed with pregnant patients and their relatives. Chi et al[19] recommended observation for symptomatic patients at >32 weeks of gestation and surgery for patients with severe neurological deficits at <32 weeks of gestation. In our review of the 32 cases (including the present cases), 26 (81.25%) underwent surgery after delivery.[8–12,14–31] Based on our experience and the reviewed reports, surgery is indicated for patients with severe or rapidly developing neurological deficits (muscle strength grade less than 3/5), especially for those with sphincter disturbance and vertebral fracture,[9,29] no matter the trimester. Before surgery, the patients should first be evaluated by obstetricians for the possibility of vaginal delivery or cesarean. The surgery should be performed as long after delivery as possible. Observation is indicated for symptomatic patients with slow-progressing VHs. Furthermore, the potential risks and benefits of surgery should be discussed with the patients and their relatives.

The choice of surgery is also controversial. Complete tumor resection (intralesional vertebrectomy or total en bloc spondylectomy) is recommended by some surgeons to reduce the possibility of recurrence.[3,6,15,37] However, long surgery time and blood loss increase risk in pregnant patients. In our cases and the reviewed cases, decompression surgeries by laminectomy were usually performed, a technique requiring less skill and a shorter surgery time, which may suitable for pregnant patients. With intraoperative vertebroplasty and adjuvant radiotherapy after surgery and delivery, laminectomy may reduce blood loss and the likelihood of recurrence.[20,36,38]

Although radiotherapy has been successfully used for the treatment of aggressive VHs with neurological deficits,[39–41] we do not recommend its use in pregnant patients due to potential harm to fetuses,[42] unless radiotherapy is performed after delivery.

Due to limitations inherent to a case study, additional research with more patients is warranted to completely evaluate the management of aggressive VHs during pregnancy.

Author contributions

Data curation: Ben Wang, Feng Wei, Zhong Jun Liu.
Funding acquisition: Liang Jiang.
Investigation: Zhong Jun Liu.
Methodology: Ben Wang, Feng Wei, Xiao Guang Liu, Zhong Jun Liu.
Resources: Xiao Guang Liu.
Supervision: Liang Jiang.
Writing – original draft: Ben Wang.
Writing – review & editing: Liang Jiang.

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