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), 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
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 posterolateral fusion. The estimated blood loss was 1200mL. 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 (82.45U/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 for suspected spinal metastasis tumor with intraoperative radiofrequency ablation and vertebroplasty. The estimated blood loss was 1200mL. 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
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 300mL 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
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 |
| Liu et al[39] (1988)         | 25  | 22                 | Paraplegia| T4        | Resection with rib grafts (antepartum) | Alive          | 21              | Complete relief |
| Schwartz et al[80] (1989)    | 30  | 30                 | Paraplegia| T5        | Laminectomy (antepartum, second surgery postpartum due to symptom recurrence) | Alive          | 2               | Complete relief |
| Redekop et al[86] (1992)     | 20  | 34                 | Paraplegia| T12       | Laminectomy (postpartum) | Alive          | 9               | Partial relief  |
| Tekkok et al[77] (1993)      | 25  | 35                 | Paraplegia| T5        | Laminectomy (postpartum) | Alive          | 3               | Complete relief |
| Abi-Fadel et al[81] (1997)   | 28  | 34                 | Paraplegia| T9        | Laminectomy and adjuvant radiotherapy (postpartum) | Alive          | Not mentioned   | Complete relief |
| Castel et al[82] (1999)      | 27  | 28                 | Paraplegia| T8        | Laminectomy (postpartum) | Alive          | Not mentioned   | Complete relief |
| Schwartz et al[83] (2000)    | 29  | 41 (postpartum)    | Paraplegia| T11       | Corpectomy and adjuvant radiotherapy (postpartum) | Alive          | 8               | Complete relief |
| Chi et al[84] (2005)         | 26  | 24                 | Paraplegia| C7        | Laminectomy, foraminotomy and vertebroplasty (postpartum) | Alive          | 4               | Complete relief |
| Inamasu et al[85] (2006)     | 20  | 33                 | Cauda equina syndrome | L2        | Laminectomy (postpartum) | Alive          | 6               | Complete relief |
| Yuksel et al[86] (2007)      | 21  | 21                 | Paraplegia| T9        | Laminectomy (postpartum) | Alive          | Not mentioned   | Complete relief |
| Vijay et al[87] (2008)       | 22  | 26                 | Paraplegia| T11       | Laminectomy with embolization (antepartum) | Alive          | 28              | Complete relief |
| Kiroglu et al[88] (2009)     | 22  | 36                 | Paraplegia| T4        | Embolization (postpartum), vertebroplasty 2 years later | Alive          | 6               | Complete relief |
| Blecher et al[89] (2010)     | 35  | 35                 | Radiculopathy| L4        | Laminectomy and vertebroplasty (postpartum) | Alive          | 12              | Complete relief |
| Saeed et al[90] (2010)       | 27  | 30                 | Paraparesis| T3-5      | Laminectomy (postpartum), embolization and corpectomy the second time | Alive          | 24              | Complete relief |
| Shinozaki et al[91] (2010)   | 27  | 31                 | Paraplegia| T2        | Laminectomy (postpartum) | Alive          | Not mentioned   | Complete relief |
| Jankowski et al[92] (2012)   | 27  | 34                 | Paraparesis| T6        | Thoracotomy (postpartum) | Alive          | Not mentioned   | Partial relief  |
| Gupta et al[93] (2014)       | 23  | 28                 | Paraplegia| T3-5      | Laminectomy (postpartum) | Alive          | 3               | Partial relief  |
| Moles et al[94] (2014)       | 28  | 35                 | Paraparesis| T3        | Laminectomy (postpartum), vertebroplasty 9 months later | Alive          | 18              | Complete relief |
| Slimani et al[95] (2014)     | 35  | 36                 | Radiculopathy| T7        | Laminectomy (postpartum) | Alive          | 21              | Complete relief |
| Elmadag et al[96] (2015)     | 19  | 38                 | Paraplegia| T4        | Corpectomy (antepartum) | Alive          | 3               | Complete relief |
| Meng et al[97] (2015)        | 28  | The second trimester | Paraparesis| T3        | Corpectomy with embolization (postpartum) | Alive          | 63              | Complete relief |
|                             | 29  | The second trimester | Paraparesis| T6        | Complete posterior tumor resection (postpartum) | Alive          | 46              | Complete relief |
|                             | 28  | The second trimester | Paraplegia| T7        | Complete posterior tumor resection (postpartum) | Alive          | 43              | Complete relief |
|                             | 30  | The second trimester | Parapresis and superior mesenteric artery syndrome | L1, L3    | Complete posterior tumor resection (postpartum) | Alive          | 32              | Complete relief |
|                             | 32  | The third trimester | Parapresis| T4        | En bloc spondylectomy (postpartum) | Alive          | 24              | Complete relief |
| Slaikou et al[98] (2015)     | 32  | 41 (postpartum)    | Severe pain due to fracture | L2        | Posterior stabilization | 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)    | Parapresis| 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).

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. 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. Typical VH lesions have vertical trabeculation and a honeycomb appearance on MRI. MRI is usually performed for patients with atypical imaging feature, percutaneous CT-guided biopsy may be helpful. 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. Timely surgery may save neurological function. Most of the reviewed cases achieved excellent symptom relief by surgical treatment. However, surgery and indications should undergo careful evaluation and be fully discussed with pregnant patients and their relatives. Chet al 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.

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, 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 asymptomatic 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. 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.

Although radiotherapy has been successfully used for the treatment of aggressive VHs with neurological deficits, we do not recommend its use in pregnant patients due to potential harm to fetuses, 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

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