

Symptomatic vertebral hemangioma during pregnancy period: A case series and systematic literature review

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Abstract

Vertebral Hemangioma (VH) is a benign tumor usually symptomless and discovered incidentally. Pregnancy, because of several hormonal and physiologic changes, is a recognized risk factor coinciding with the development of a rapid onset of neurological symptoms in patients affected by VH. In the Literature, sporadic cases of neurological symptoms have been described, which occurred during pregnancy, but only rarely the onset of symptoms was reported after pregnancy and childbirth. Usually surgical treatment is reserved for severe cases with rapid onset of neurological symptoms. However, the use of conservative treatments is still a topic of debate. In the present study, we report a series of patients affected by VH become symptomatic during or after pregnancy along with a systematic review of the Literature.

Introduction

During pregnancy the most frequent oncologic lesions are breast cancer tumors, hematologic tumors and dermatologic tumors while spinal tumors are very rare.¹ Vertebral Hemangioma (VH) is a benign tumor usually discovered incidentally.² Because of several biological changes, pregnancy is recognized as a risk factor for the development of a rapid onset of symptoms from these normally asymptomatic lesions. Less than 1% of VH cause neurologic symptoms from spinal cord or nerve root compression; they can lead to serious neurologic deficits if not promptly treated.^{1,2} In the present investigation was reported a series of patients affected by VH become symptomatic during or after pregnancy. We also perform a systematic review of the Literature.

Materials and Methods

A systematic review of the literature indexed in PubMed, MEDLINE, Scopus and Cochrane Library databases, using as search-terms "Spine" OR "Spinal" OR Vertebral" AND "Hemangioma" OR "Angioma" AND "Pregnancy" OR "Parturition" OR "Pregnant woman" and their MeSH terms combinations was performed. The Preferred Reporting Items for Systematically Reviews and Meta-Analyses (PRISMA) was followed as reported in Figure 1. The inclusion criteria of the review was the presence in the evaluated manuscript of: demographic features, symptoms, diagnostic settings, treatment, possible complications and outcomes in patients with symptomatic VH during or immediately following the pregnancy. Only English article with an available abstract were considered eligible for the reviews. Abstracts and full-texts were independently screened by two authors (A.P. and M.C.M.), any discordance was solved by consensus with a third author (D.A.S.).

Case Report #1

A 21-years-old previously healthy woman was referred to our emergency unit because of a right lower limb weakness started 2 weeks after delivery. No relevant clinical history or traumas were reported. Her pregnancy was unremarkable, and the new-born was normal. Physical examination showed bilateral strength deficit at lower limbs (2/5 MRC), hypo responsive knee-jerk reflex and Achilles reflex on both limbs, Babinski reflex positive to the right, urinary retention. Computer Tomography (CT) images showed L1 vertebral compression fracture (Figure 2a,b) with protrusion of bony fragments into the spinal canal with an honeycomb pattern (Figure 2c). Magnetic Resonance (MR) images showed an altered structure in L1 vertebra, marked by a hypo intense signal in T1 images and hyper intense in T2 (Figure 2d), the somatic collapse of L1 suggestive for an aggressive hemangioma induced by recent pregnancy. Other multiple hemanangiomas were localized in vertebral body of metamer T2-8 tract; the larger one is in T8. A surgical approach was necessary due to the severity of the symptoms and the rapidity of onset. In the first surgical stage a wide posterior thoracolumbar decompression by laminectomy with trans-pedicle screw fixation D12-L1, after endovascular embolization of the lesion, was performed (Figure 3). The second surgical stage consisted in percutaneous vertebroplasty of

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VH in T8 with the use of poly-methyl-methacrylate (PMMA) and endovascular embolization of L1 with polyvinyl alcohol. After angiographic evaluation, corpectomy with titanium cage reconstruction was performed. Histological evaluation of the surgical samples showed typical characteristics of aggressive hemangioma. The day after surgery the patient reported an improvement in sensitivity in the lower limbs. After three days there was an improvement in strength in the legs and disappearance of urinary retention after removing the urinary catheter. A week after surgery, the patient walked with help and was therefore transferred to a rehabilitation facility. After 3 months' neurological

examination was normal, no signs of implant loosening or mobilization were noted in the control X-Ray images (Figure 2) and the patient was satisfied with the treatment received. At the last follow up visit, 24 months after surgery, the patient's neurological examination was normal, and no signs of recurrence was found.

Case Report #2

A 34-year-old healthy woman was referred to our spine surgery unit for worsening back pain started immediately after a natural vaginal delivery. The pregnancy was unremarkable and the newborn was normal. The patient had no notable medical history. A physical examination revealed signs of lumbar tightness with back pain scored 9/10 on the Visual Analogue Scale (VAS). The back pain getting worse in up stand and sitting position while relieved in down stand position. No neurological symptoms were found. A spinal X-Ray showed a L1 compression fracture. CT images confirmed a L1 compression fracture (Figure 4a-c) without protrusion of bony fragments into the spinal canal and a honeycomb aspect of L1 vertebra. MR images showed an altered structure in L1 vertebra, with somatic collapse, suggestive for an aggressive hemangioma exacerbated by pregnancy. Surgical approach was necessary for the worsening symptoms. A percutaneous trans-pedicle screw fixation between D12 and L2 was performed. Trans-pedicle percutaneous somatic biopsy of L1 vertebra was done. Histological exams showed aggressive hemangioma. The day after surgery the patient demonstrated good pain relieve in up stand and sitting position. She was able to walk with semi-rigid

thoracolumbar brace. The post-operative course was uncomplicated and the patient was discharged 4 days after surgery. At 3 months follow up visit the patient was able to walk without aids and the back pain was completely resolved. At 1 year follow up visit no X-Ray loosening signs of the implant were found (Figure 4d,e) and the patient planned a second pregnancy.

Case Report #3

A 33-year-old healthy woman, gravid 1 para 0, was admitted to our spine unit due to

an acute onset of progressive paraplegia with lack of sphincters continence and acute intrascapular pain in her 14th week of pregnancy. A physical examination revealed a flaccid paraplegia in the lower limbs with abolition of deep tendon reflexes in lower extremities, decreased sensation below the T2 level and bilateral positive Babinski sign. MR imaging showed a vertebral lesion occupying the T2 vertebral body with massive epidural extension and spinal cord compression (Figure 5a).

Due to the rapid onset of symptoms, an attempt of urgent surgical decompression by extensive laminectomy of T1-T3 after fixation with trans-pedicle screws was made.

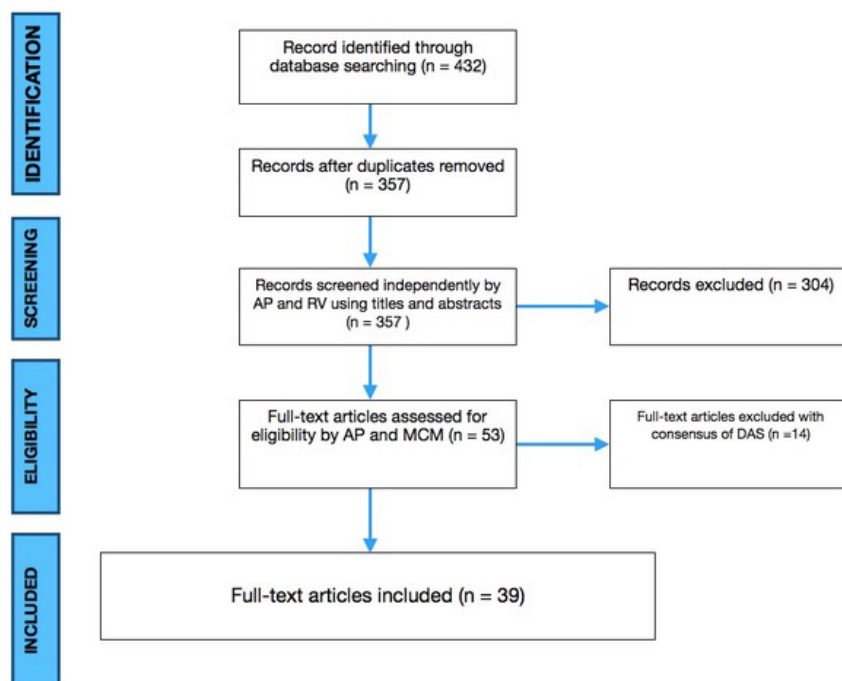


Figure 1. PRISMA Flow-chart.

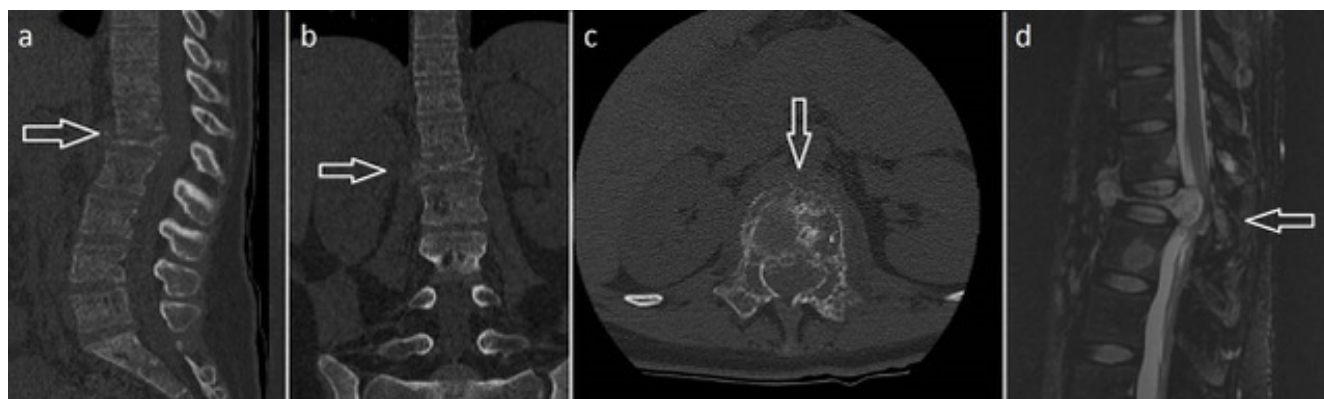


Figure 2. a-c) TC images showing complete collapse of L1 with back wall protruding into the spinal canal, in figure c there was bone changes extended to both the pedicles (honey comb pattern). d, MR images showing vertebral body collapse and cord compression.

However, due to the massive intra-operative bleeding, decompression could not be completed. The day after surgery the neurological condition was unchanged therefore an arteriography was performed with subsequent embolization of the lesion by Contour (250-355 microns) (Figure 5b). Afterwards, laminectomy was completed along with a piece-meal excision of the lesion in a second stage. At the end of the procedure, the spinal cord appeared free of significant compressions. Histological examination of intra-operative samples leads to diagnosis of aggressive hemangioma.

The day after surgery no neurological improvement was noted, however the patient reported a sensation improvement up to T8 level. The post-operative course was uncomplicated. In the 10th day after surgery the patient was able to sustain sitting position. An improvement of the motor power in the lower limb (2/5 MRC) was found. She was transferred in rehabilitation facility 15 days after surgery. Thirty days after surgery the patient had an abortion. At the follow-up visit performed 3 months after surgery, the MR images showed a reduction of the T2 lesion with a compression-free epidural space (Figure 5c). The patient showed a partial recovery of strength in the lower limbs (4/5 MRC) and was able to walk on crutches. Her bladder and rectal function returned to normal. It was not possible to get further evaluation of this patient because she was lost during follow up.

Systematic Literature review

Patients features and demographical data

Only a few cases of VH became symptomatic during pregnancy or

immediately after delivery were reported in the Literature. A total of 357 reports, excluding duplicates, were independently screened, thereby 39 were finally included in our review (Figure 1). Numbers software

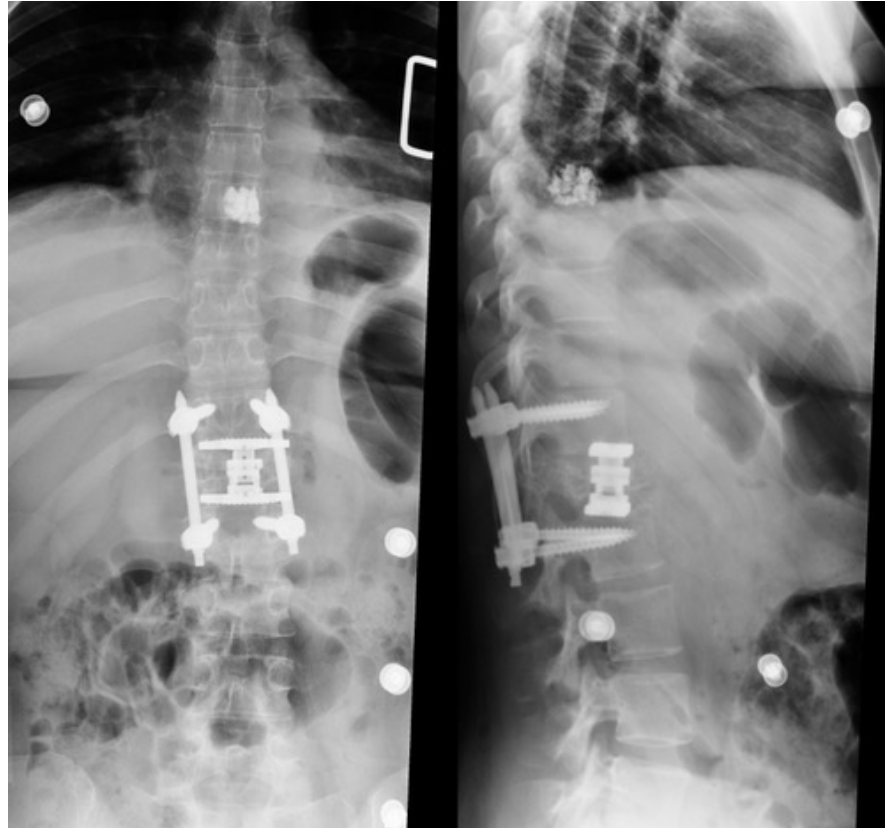


Figure 3. Radiograph at 3 month of follow-up.

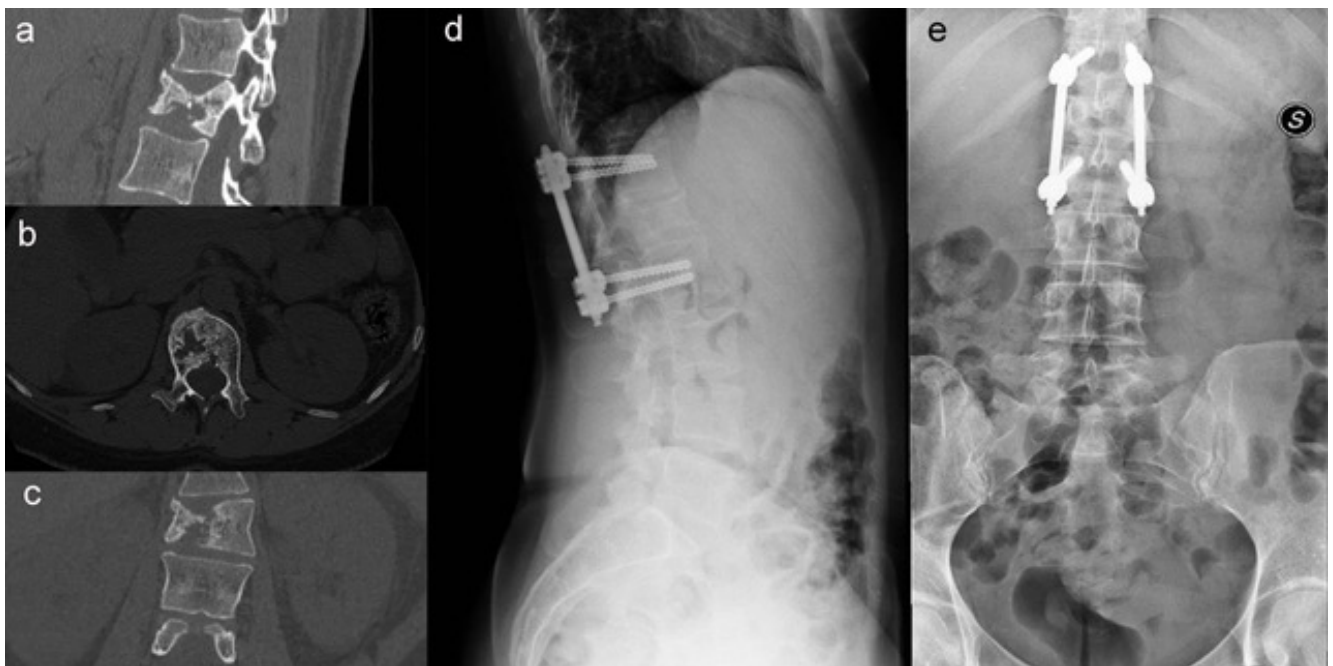


Figure 4. a-c) TC images showing compression fracture of L1body. d,e) Radiograph at 3 month of follow-up.

(Apple Inc., Cupertino, CA) was used to tabulate the obtained data. Our review showed 49 cases, including our patients, of VH reported in the Literature.¹⁻³⁹ The mean age of included patients was 28.2 (+/- 6.6) years, the mean follow up time was 16.1 months (+/-16.1). Demographic and clinical features are summarized in Table 1.

Symptoms onset, localization and diagnosis

Symptoms occurred during pregnancy in 38 patients (77%), mostly at the 29th week of gestation. In 11 patients (23%), including our, the symptoms began after delivery. Presentation symptoms were: paraplegia in 30 cases (61%), paraparesis in 16 (33%), back pain in 13 (26%). Seven patients (14%) reported a compression fracture of the affected vertebra.

VH seems to be prevalent in the thoracic segment (39 patients, 80%), followed by the lumbar spine (6 patients, 12%) and the cervical spine (4 patients, 8%). In all case except two (95.9%) a histological diagnosis was made.

Treatment and outcomes and complication

Forty-five patients (91.8%) were surgically treated. In 36 patients (73.4%) only surgical treatment was performed, while in 6 patients (12.2%) surgery was in association with VH embolization and in 3 patients (6.1%) with Radio-Therapy (RT). Only in two cases (4.1%) the patients were treated exclusively through RT. The chosen surgical approaches were: posterior decompression in 26 patients (53%), posterior decompression and fusion in 8 cases (16.3%), anterior decompression and

fusion in 5 cases (10.2%), anterior and posterior decompression and fusion in 4 cases (8.2%) and only posterior fusion in two cases (4%). In 4 cases (8.2%) a vertebroplasty of the affected vertebra was associated with surgical treatment.

Concerning neurological outcomes: 32 patients (65.3%) demonstrated a complete recovery, 13 patients (26.5%) only partial recovery, whereas two patients (4.2%) does not demonstrated any neurological recovery; the same two patients died few day after surgery.

About complication: recurrence of the disease was found in 3 patients (6.1%), therefore they underwent reoperation; one patient had a *P. Aureginosa* infection treated with antibiotic therapy.

Concerning the new-borns and pregnancy: in 31 cases (63.2%) the delivery was unremarkable with normal baby, in 3 cases (6.3%) the new-borns were premature, in 2 cases (4.2%) the babies died during delivery and in one case a patient had an abortion.

Discussion

Background

Most of VH are asymptomatic and the thoracic spine represent the most commonly affected level. VH can cause neurological impairment through multiple mechanisms like expansion of bony elements, epidural expansion of tumor tissue, disturbance of local blood flow or rarely compression fracture of the vertebral body associated with epidural hematomas.^{2,40} Pregnancy,

particularly during the third trimester, is also recognized as a risk factor for symptomatic conversion due to hormonal and biomechanical alterations.⁴¹ During pregnancy in fact, the increased blood volume leads to an increased venous pressure inside the hemangioma. The vertebral venous plexus becomes more congested due to the increased pressure of the vena cava compressed by the uterus leading to increased dimension of the hemangioma.^{1,22} The high levels of estrogen hormones also stimulate the endothelial proliferation with increased dimension of the lesion even without specific estrogen's receptors. The increased size of the hemangioma and due to the high pressure level of the vertebral plexus can compress the spinal cord and reduce its perfusion.^{42,43} On one hand, the presence of aggressive hemangioma with onset of symptoms in the postpartum period is poorly described in the literature and reported only in some sporadic cases,⁴³ on the other hand, usually, during pregnancy and post partum period, acute and sub-acute low back pain with the related symptoms are very common.⁴⁴⁻⁴⁶

When vertebral hemangioma becomes symptomatic prompt decompression and stabilization are necessary with a histological identification of the lesion. The rapid progression of the symptoms could have been associated with a recurrence of the lesion. Surgical decompression and fixation, open or hybrid/mini-invasive surgery (MIS), was reserved for cases of neurological symptoms; percutaneous posterior transpedicle screw fixation (without decompression) may be reserved for all cases of compression fractures without



Figure 5. a) MR images showing T2 vertebral body lesion with epidural invasion and cord compression. b) Fluoroscopic image obtained during embolization. c) MR images at 3 months of follow-up showing a reduction of the lesion in T2 and free-compression spinal cord.

Table 1. Review of the recent literature.

Study	Case	Week of Pregnancy	Age (Year)	Baby	Symptoms	Level involved	Complication	Treatment	Neurological Outcome	Follow Up (month)
Guthkelch AN <i>et al.</i> , 1948	1	36	34	Normal	Paraplegia, BP	T6	Died	PD	Unchanged	–
Lam LM <i>et al.</i> , 1951	2	34	36	Normal	Paraplegia	T3	–	PD	Complete Recover	–
Askenasy H <i>et al.</i> , 1957	3	38	20	Normal	Paraplegia	T11	–	PD	Complete Recover	24
Fields WS <i>et al.</i> , 1957	4	28	30	Normal	Paraplegia	T6	–	PD	Complete Recover	–
Newman MJD 1958	5	39	24	Normal	Paraplegia	T2	–	PD	Complete Recover	3
	6	32	34	Normal	Paraplegia	T4-5	Died	PD	Unchanged	–
	7	32	35	Normal	Paraplegia, BP	L3	–	RT	Partial Recover	24
Newquist RE <i>et al.</i> , 1959	8	24	18	Premature	Paraplegia, UR	C7-T1	Infection P. Aureginosa	PD	Partial Recover	12
Nelson DA <i>et al.</i> , 1964	9	28	16	Died	Paraplegia	T3	–	PD, RT	Partial Recover	10
Esparza <i>et al.</i> , 1978	10	24	22	–	Paraplegia	T5-T7	–	PD, Emb	Complete Recover	–
Faria SL <i>et al.</i> , 1985	11	32	40	–	Paraplegia	T3	–	RT	Complete Recover	–
Lavi E <i>et al.</i> , 1986	12	29	25	1 Died						
				1 Hydrocephalus	Paraplegia, BP	T4	–	PD	Complete Recover	1
				2 Normal						
	13	34	21	Normal	Paraparesis, Sciatica	T2	–	PD	Complete Recover	–
CL Liu <i>et al.</i> , 1988	14	22	25	Normal	Paraparesis	T4	–	ADF	Complete Recover	21
Schwartz DA 1989 <i>et al.</i> ,	15	30	30	–	Paraplegia	T5	–	–	Complete Recover	–
Poungvarin N <i>et al.</i> , 1991	16	8	20	–	Paraparesis	T2	–	PD	Partial Recover	–
Redekop GJ <i>et al.</i> , 1992	17	7 AD	20	Normal	Paraplegia, BP	T12	–	ADF; Emb	Partial Recover	9
Tekkök IH <i>et al.</i> , 1993	18	1 AD	25	Normal	Paraplegia, BP, UR	T5	Reintervention	PD	Complete Recover	1
Ogasawara KK <i>et al.</i> , 1995	19	35	23	Mild respiratory distress syndrome	Paraplegia	T5	–	PD	Partial Recover	–
Castel E <i>et al.</i> , 1999	20	24	27	Normal	Paraplegia	T8	–	PDF	Partial Recover	–
Schwartz TH 2000 <i>et al.</i> ,	21	1 AD	29	Normal	Paraplegia	T11	Compression Fracture T11	ADF, RT	Complete Recover	–
Shapiro GS <i>et al.</i> , 2001	22	8 AD	39	Normal	Paraparesis	T5-T9	–	PD	Complete Recover	18
Chi JH <i>et al.</i> , 2005	23	24	26	Normal	Paraplegia	C7	–	ADF	Complete Recover	4
Inamasu J <i>et al.</i> , 2006	24	33	20	–	Paraplegia, BP	L2	Compression Fracture L2	PDF	Complete Recover	6
Yuksel M <i>et al.</i> , 2007	25	28	21	–	Paraplegia	T9	–	PD	Partial Recover	–
Hakan T <i>et al.</i> , 2007	26	1 AD	36	Normal	Paraparesis	T5-T6	–	PD	Complete Recover	2
Vjaj K <i>et al.</i> , 2008	27	26	22	Normal	Paraplegia	T11	Recurrence, Reintervention	PDF, VP	Complete Recover	28
Kiroglu Y <i>et al.</i> , 2009	28	36	22	Normal	Paraplegia	T4	–	PDF, Emb, VP	Complete Recover	6
Blecher R <i>et al.</i> , 2010	29	37	35	Normal	Paraparesis	L4	–	PD, VP	Complete Recover	12
Shinozaki M <i>et al.</i> , 2010	30	28	27	–	Paraplegia	T2	–	APDF, Emb	Complete Recover	18
Oppenlander ME <i>et al.</i> , 2012	31	16 AD	36	Normal	Paraparesis, AW	C5	–	APDF	Partial Recover	6
Gupta M <i>et al.</i> , 2014	32	28	23	Normal	Paraparesis	T3-T5	–	PD	Partial Recover	3
Jain RS <i>et al.</i> , 2014	33	1 AD	26	Normal	Paraplegia	T9	–	Refused	–	–
Moles A <i>et al.</i> , 2014	34	35	28	–	Paraparesis, BP	T3	–	PD, VP	Complete Recover	18
	35	36	35	–	BP	T7	Compression Fracture T7	PDF	Complete Recover	21
Silmani O <i>et al.</i> , 2014	36	38	19	–	Paraplegia	T4	–	ADF	Complete Recover	3
Meng T <i>et al.</i> , 2015	37	24	28	Normal	Paraparesis, BP	T3	–	PD	Complete Recover	63
	38	24	29	Premature	Paraparesis, BP	T7	–	PD	Complete Recover	46
	39	24	28	Premature	Paraplegia	T6	–	PD	Complete Recover	43
	40	24	39	Normal	Paraparesis, BP	L1, L3	–	PD	Complete Recover	32
Staikou C <i>et al.</i> , 2015	41	1 AD	32	Normal	BP, LW	L2	Compression Fracture L2	PF	Complete Recover	6
Demirkale I <i>et al.</i> , 2016	42	23	40	Normal	Paraparesis	T1	–	PDF	Complete Recover	24
Korkmaz M <i>et al.</i> , 2016	43	35	33	–	Paraparesis	T6-T8	–	PD, Emb	Complete Recover	–
Fereydonyan N <i>et al.</i> , 2017	44	34	28	Normal	Paraplegia	T5	Recurrence, Reintervention	APDF	Partial Recover	3
Bennis A <i>et al.</i> 2019	45	34	33	Normal	Paraplegia	T9-T10	–	PD	Complete Recover	1
Wang GX <i>et al.</i> 2019	46	1 AD	35	Normal	Paraparesis	T5	Compression Fracture T5	PDF, VP	Partial Recover	6
Present series	47	2 AD	21	Normal	Paraparesis	L1	Compression Fracture L1	APDF, Emb	Complete Recover	24
	48	1 AD	34	Normal	BP	L1	Compression Fracture L1	PF	Complete Recover	12
	49	14	33	Abortion	Paraplegia, BP	T2	–	PDF, Emb	Partial Recover	3

AD: After delivery; ADF: Anterior Decompression with fusion APD: Anterior and Posterior Decompression; APDF: Anterior and Posterior Decompression with fusion; AW: Arm Weakness BP: Back Pain; Emb: Embolization; FI: Fecal Incontinence; LW: Leg Weakness; NC: neurogenic claudication; PD: Posterior Decompression; PDF: Posterior Decompression with Fusion; PF: Posterior Fusion; RT: Radiotherapy; UI: Urinary Incontinence; UR: urinary retention VP: Vertebroplasty.

neurological impairment.^{32,47-50} As reported in the current literature, post-operative radiotherapy is recommended in cases of aggressive vertebral hemangioma treated with partial resection to reduce the risk of recurrence.^{1,32} The meaning of radiation therapy is still under debate and there's a lack of evidence about its results and about the criteria for eligible patients for this therapy.^{32,43}

Present case series

Due to the rapid onset of symptoms in the first case, a prompt decompression and fixation was necessary, but, in consideration of the size of the lesion and the high risk of bleeding, a second stage was requested to complete the L1 corpectomy. First surgical stage was important to regain the lower limb mobility and to guarantee a partial regression of the neurological symptoms that improved more after the second surgical stage. In this case since two different vertebral body were involved the histological analysis was absolutely necessary to differentiate it from other neoplastic lesions.^{32,43} In the second case, due to the absence of neurological symptoms and in presence of a compression fracture of L1 vertebra, a percutaneous fixation was adequate to obtain good clinical results with all advantages reserved to MIS surgery.⁴⁷⁻⁵⁵

In the third case, the major bleeding during urgent surgery made evident the effectiveness of embolization procedures in angiomatous lesions.

Conclusions

To date the best treatment of aggressive VH in pregnancy is still controversial, many valid options are available, but, from our experience and the review of the literature, the suggestion is to be as radical as possible. A prompt and wide decompression, with or without fixation represent the treatment of choice in case of neurologic compression. Pre-operative embolization of the lesion, when possible, should be performed to avoid major bleeding during surgery. Other options are still a topic of debate.

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