



Disponible en ligne sur

ScienceDirect  
www.sciencedirect.com

Elsevier Masson France

EM|consulte  
www.em-consulte.com



Short clinical case

# Acute idiopathic spinal subdural hematoma: What to do in an emergency?

C. Joubert<sup>a,\*</sup>, S. Gazzola<sup>a,b</sup>, A. Sellier<sup>a</sup>, A. Dagain<sup>a</sup><sup>a</sup> Department of neurosurgery, Sainte Anne Military Hospital, France<sup>b</sup> Department of Interventional Radiology, Sainte Anne Military Hospital, France

## ARTICLE INFO

## Article history:

Received 11 March 2018  
Received in revised form 16 August 2018  
Accepted 6 October 2018  
Available online 8 February 2019

## Keywords:

Acute paraparesis  
Spinal MRI  
Angiography  
Idiopathic spinal subdural hematoma

## ABSTRACT

Acute spinal cord compression usually results from trauma, infection, or cancer. Spinal subdural hematoma is an uncommon cause of spinal cord compression that occurs after spine trauma or spinal invasive procedure, especially in context of coagulopathy. In the following reported case, an 82-year-old woman with a history of rapidly progressive paraparesis after a sudden middle back pain, with no previous trauma or coagulopathy, due to an acute spontaneous spinal subdural hematoma. In fact, the main difficulty was to determine, in an emergency situation, the right strategy to identify both the lesion and its cause to adapt therapeutics. This case not only provides an illustrative unusual condition in an emergency department but also a challenging discussion to choose the right treatment for a sudden neurological impairment. According to a literature review of the idiopathic cases of spinal subdural hematomas without coagulopathy, the clinical outcome depends on severity of neurological impairment. MRI is the main examination to perform in an emergency. Thus surgical evacuation should be performed in emergency in patients presenting with severe neurological impairment.

© 2019 Elsevier Masson SAS. All rights reserved.

## 1. Introduction

Acute spinal cord compression usually results from trauma, infection, or tumor [1–5]. Classically, spinal hematomas are located in the epidural space, in patients suffering from trauma or hematologic diseases [1,6]. They also may follow spinal surgery or anesthesiology procedures [3]. Thus, acute idiopathic spinal subdural hematoma remains a rare cause of spinal cord compression, especially in patients without coagulation problems [7,8]. As this condition whose outcome is dependent on judicious intervention we report an uncommon and illustrative case of spontaneous spinal subdural hematoma. Furthermore, we propose a literature review of all the cases of idiopathic spinal subdural hematoma without coagulation disorder published in order to guide diagnosis and treatment in emergency.

### 1.1. Case report

An 82-year-old woman presented with a twenty-four hour history of rapidly progressive weakness in both legs after a sudden middle back pain, with no previous trauma. There was no previous history of underlying neoplasm or coagulopathy. Neither antiplatelet treatment nor anticoagulant therapy was reported. Physical examination revealed a symmetric paraparesis sub T12 with average muscle strength of 2/5 and both bowel and bladder dysfunctions, quoted ASIA C, or grade II according to the classification of Domenicucci et al. [8].

Spinal MRI imaging demonstrated the spinal cord compression due to an acute posterior subdural hematoma extending from T10 to L2, below the conus medullaris, with the major portion at T12–L1, in hyposignal in both T2 (Fig. 1A, C) and T1 (Fig. 1B) weighted sagittal sequences, testifying the acute mechanism, and concordant with the patient's clinical history. The T1-weighted sequence with gadolinium did not show any associated vascular malformation but still enlightened the heterogeneous degeneration of blood products, especially in the middle part of the circumferential clot whose main part was spreading onto the posterior part of the medullar canal. Moreover, spinal selective angiography was performed from L3 to T4, and only demonstrated that the anterior spinal artery arose from the left inter segmental T12 artery, without any underlying vascular malformation.

\* Corresponding author. Department of neurosurgery, Sainte Anne Military Hospital, 2, boulevard Sainte Anne, 83000 Toulon, France.

E-mail addresses: [christophe.joubert@neurochirurgie.fr](mailto:christophe.joubert@neurochirurgie.fr) (C. Joubert), [sebastien.gazzola@gmail.com](mailto:sebastien.gazzola@gmail.com) (S. Gazzola), [aurore.sellier@live.fr](mailto:aurore.sellier@live.fr) (A. Sellier), [dr.adagain@gmail.com](mailto:dr.adagain@gmail.com) (A. Dagain).



**Fig. 1.** Both T2 (A, C) and T2 (B) weighted MRI sequences demonstrated the spinal cord compression due to an acute posterior subdural hematoma extending from T10 to L2, below the conus medullaris, in heterogeneous iso and hypointense on the sagittal view. Both hypointense T1 and T2 weighted MRI sequences were in favor of a subacute bleeding since 24 h and before 3 days [21]. Interestingly, LCS appeared in isointense even in T2 weighted sequence that was in line with per operative observation of a violated arachnoid layer and intra-arachnoid hemorrhage. In axial view T2 weighted sequence, the spinal subdural hematoma appeared in posterior position realizing the “cap sign” [31]. Postoperative sagittal T2 weighted sequence (1D) did not show any residual collection after laminectomy extended from T11 to T1.

Therefore, surgical removal by laminectomy from T11 to L1 and durotomy was performed in emergency (Fig. 2). As suspected on the MRI, hemorrhage was spreading out into the subarachnoid space, due to arachnoid layer dehiscence. After clot removal and carefully washout of the subarachnoid space, no malformation was observed. Histopathological examination of the clot did not demonstrate any underlying lesion.

Four weeks after surgery, there was no sphincter dysfunction, and motor recovery permitted walking without any walking aids. At 6 months clinical examination, the patient did not display any remnant motor or sensitive sign. The post-operative MRI including angio-MRI sequence did not show any lesion (Fig. 1D).

## 2. Discussion

### 2.1. Epidemiology

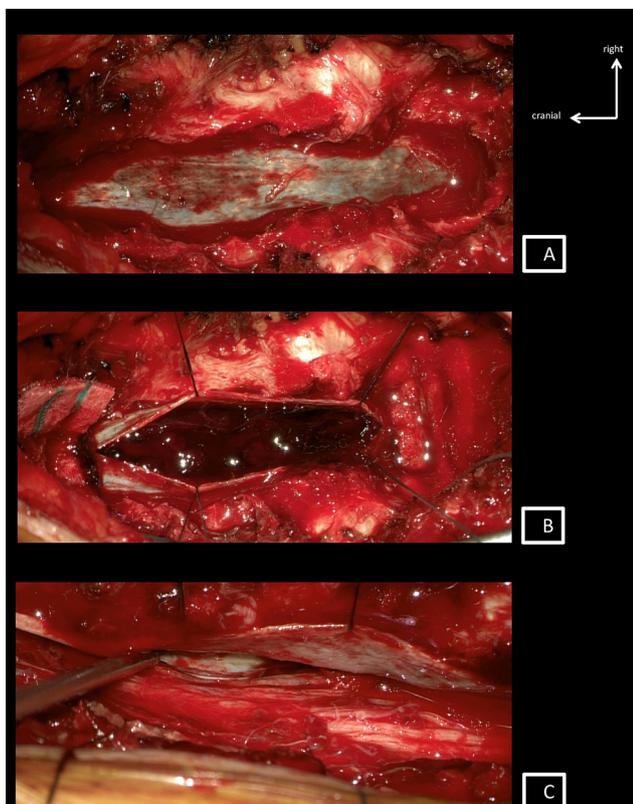
Spinal subdural hematoma is a rare cause of spinal cord compression [3]. Apart from iatrogenic procedures or anticoagulant therapy, diagnosis may be challenging, as illustrated herein. Among more than 150 reported cases of spinal subdural hematoma, only 37 thirty cases, reported in the Table 1 with their baseline characteristics, can be qualified as being “idiopathic”, including the present case [1,3]. Particular attention must be paid to “idiopathic” cases which remains challenging in order to accurately review all the cases of the real idiopathic spinal subdural hematomas as the term “idiopathic” is often used in cases with no underlying lesion but with coagulation disorders. In the present review we only considered patients without any anticoagulant disorder.

#### 2.1.1. Clinical symptoms

Despite any spinal trauma or spinal procedure, anamnesis firstly aims at disclosing any coagulopathy or anticoagulant treatment. Clinical examination states motor and sensitive signs of spinal cord compression, its level and functional impairment. Historically, clinical presentation was classified by Domenicucci et al. [1] in 4 levels (grade 0 = normal; I = weakness, pain and/or mild hypoesthesia; II = invalidating paresis and level of hypoesthesia; III = abolished motor and sensory capacities). Mid neurological impairment that is to say grade 2 corresponding to class ASIA C, remains the most encountered presentation in the cases reported ( $n = 22$ , 59,5%). Acute or sub-acute installation of neurological impairment with sudden back pain, without trauma, suggests a bleeding process leading to spinal cord compression and seems to be the most reported clinical onset [1,3,9,10]. However, no pathognomonic sign has been previously described in the literature [1,3].

#### 2.1.2. Radiological features

If spinal imaging should be performed in an emergency situation, neuroradiological diagnosis remains difficult, especially on CT scan without myelography [1,9]. If myelography and then CT myelography were used in the first cases reported [11–18], MRI became the examination of choice in emergency [9,19,20]. Thus, MRI can show both the hematoma and its location regarding the dural space, and usually enlightens the causal tumoral or vascular lesion. According to Braun et al. [21], MRI findings evolve with hemoglobin degradation and have permitted to conclude in the reported case to an acute (between one and three days) and not an hyper acute hematoma whose MRI signal appears iso- to hypo intense on T1-weighted sequence and hyper intense on T2-weighted sequence. This second feature matches with the central part of the hematoma



**Fig. 2.** Intraoperative view of the acute subdural hematoma after laminectomy, before dura mater opening (A), forming a “bluish area” according to the historical per operative observation reported by Rader in 1955 [10]. After a durotomy, the arachnoid space appeared spontaneously and widely opened by the hematoma (B). After surgical removal above the conus medullaris the nerve roots above were seen without vascular malformation (C).

reported in our case at the T11 and T12 levels, and may reveal the source of the bleeding.

In addition, the axial view is especially relevant to distinguish epidural hematomas that are usually encountered posteriorly to the spinal cord in a biconvex form, from subdural hematomas that are commonly found anterior-laterally to and around the spinal cord in a semi-circular pattern (“cap sign”), as encountered in the present case (Fig. 1C) or in tri radiate pattern (“Mercedes Benz sign”) at lumbar levels as recently described by Krishnan and Banerjee [5]. Interestingly associated subarachnoid hemorrhage can be observed on MRI as encountered in the case herein, as LCS still appeared in iso signal in MRI T2-weighted sequence above the main part of the clot. This observation was in agreement with the per-operative view of the violated arachnoid layer. In contrast, axial T2-weighted sequences demonstrated in the main part of the clot a limited hypersignal that could match with a hyper acute bleeding. Nevertheless, the different MRI sequences including gadolinium-enhanced sequences did not determine the sub or extra arachnoid origin of the bleeding, as previously reported [1,20,22], so that led us to perform prompt spinal angiography in order to disclose any underlying vascular lesion as performed in the cases n° 18, 20, 27, 33 reported in Table 1.

Furthermore, false negative spinal angiography as been previously reported and primarily attributed to operator-dependent factors (non-selectivity may be due to spontaneous thrombosis of the underlying vascular malformation [23,24]). Nevertheless, in such a situation per operative observation permitted to lead to the right etiology of vascular malformation unlike the present case. Finally, it appears reasonable to perform a second, postoperative exam, in “idiopathic” bleeding. The choice between angio-MR and

selective angiography should consider the vascular history of each patient, to minimize iatrogenic complication, so that led us to prefer in our case the first modality.

### 2.1.3. Physiopathological hypothesis

Even when selective and complete angiography also does not show any underlying lesion, as encountered herein, the origin of bleeding is thought to come from subarachnoid vessels, as spinal subdural space remains avascular [25]. Although no previous traumatic event was reported, we can hypothesize that a minor “neglected” trauma might have increased intra abdominal and intra thoracic pressure so that led to subarachnoid vessels disruption as initially described by Rader in 1955 [10,26]. More recently, in a reported case of spinal subdural hematoma post vertebroplasty, Mattei et al. emphasized the role of the congestion of the vertebral venous plexus responsible for the venous drainage of the vertebral body, leading to the rupture of the radiculo-medullary veins into the subdural space [27]. In fact, it was previously demonstrated that the radiculo-medullary veins constitute the weakest link between the intradural venous system and the epidural space [28,29].

### 2.1.4. Therapeutics and outcome

When an objective causative lesion can be diagnosed, and specifically treated, therapeutic strategy should be instigated as a matter of emergency. After the specific literature review of idiopathic spinal subdural hematoma (Table 1), three situations were encountered:

- patient grade 0 (ASIA E or D) (8 cases): recovery is the rule whatever the treatment (3 underwent surgery and 5 conservative treatment);
- patient grade III (ASIA A) (7 cases): recovery is the rule for surgical treatment ( $n = 5$ ), and was encountered for a half of non-operated patients;
- patient grade II (ASIA B or C, the present case) (22 cases): 11 patients benefited from surgery with good outcome in 9 whereas 10 patients were treated without surgery (“pulsed” corticotherapy, hyper hydration [30]) with good outcome in 8.

Despite any relevant statistical link in such a small cohort, it appears that surgical treatment of spontaneous hematomas has usually been reported in cases of severe neurological impairment with good outcome, and should be promptly performed unless the patient’s condition prevents any surgery [16]. In asymptomatic or pauci-symptomatic patients both conservative and surgical treatment has led to good outcome so that should be in favor of conservative treatment and careful clinical follow-up.

As regards the third situation, there was no statistically significant relationship found according to age, location, number of levels involved that permitted to choose between conservative treatment and surgery. Nevertheless, poor outcome was observed in young patients who underwent conservative treatment [14]. In contrast, as underlined by Pereira et al. who reviewed a larger cohort of spinal subdural hematomas—including iatrogenic and anticoagulant disorders—up to 2013, there was no better outcome for patients who underwent surgery [3]. Moreover, as observed in our literature review of idiopathic hematomas, they particularly reported that extension of the hematomas, surgery and association to subarachnoid hemorrhage were not relevant. From our viewpoint, in patients acutely or sub acutely impaired and whose condition permitted to perform surgery, it appears acceptable to purpose it without delay.

Finally, neurological impairment at initial clinical presentation remains the main predictive factor of outcome reported, for this disease that has a morbidity rate of 28%, so that suggests surgery

**Table 1**  
Baseline characteristics of the 37 idiopathic spinal subdural hematomas.

Author, year [ref]	Sex	Age	Clinical status <sup>a</sup>	Location	Number of levels	Treatment	Clinical outcome	Imaging	Associated HSA
1. Ainslie, 1958 [11]	F	67	II	T8–T10	3	Surgery	Recovery	Myelography	No
2. Banach, 1970 [13]	F	65	II	T3 - T5	3	Surgery	Recovery	Myelography	No
3. Anagnostopoulos & Gortvai, 1972 [12]	F	63	II	T8 - T12	5	Surgery	Poor	Myelography	No
4. Schwartz, 1973 [18]	M	47	II	C3–C7	5	Surgery	Recovery	Myelography	Yes
5. Reynolds & Turner, 1978 [16]	M	57	III	C	?	Conservative	Death	Myelography	No
7. Sakata & Kurihara, 1984 [17]	M	56	III	L2–S1	6	Surgery	Recovery	Myelography	No
8. Martinez, 1987 [32]	M	64	II	T5–T6	3	Surgery	Poor	Myelography	No
9. Grobovschek & Schurich, 1989 [14]	F	38	II	T6 - T11	6	Conservative	Poor	CT/myelography	No
10. Grobovschek & Schurich, 1989 [14]	F	41	II	C3–L2	19	Conservative	Poor	Myelography	No
11. Levy, 1990 [15]	M	43	I	L4–L5	2	Surgery	Recovery	Myelography	No
12. Levy, 1990 [15]	F	81	II	L3–S1	4	Conservative	Recovery	Myelography	No
13. Jacquet, 1991 [33]	M	51	I	T6–T8	3	Surgery	Recovery	CT/myelography/MRI	No
14. Grunberg, 1993 [19]	F	70	I	T3–L3	13	Surgery	Recovery	MRI	No
15. Longatti, 1994 [34]	M	54	I	T5–L5	12	Conservative	Recovery	MRI	No
16. Kang, 2000 [35]	F	49	II	T5–L3	10	Conservative	Recovery	MRI	Yes
17. Kuker, 2000 [36]	M	81	II	T3–L3	12	Surgery	Recovery	MRI	No
18. Kuker, 2000 [36]	F	55	II	T12 - L4	5	Surgery	Recovery	MRI/angio	Yes
19. Boukobza, 2001 [37]	M	74	I	T6–L4	16	Conservative	Recovery	CT/MRI	No
20. Yamada, 2003 [38]	F	38	II	T1–T7	8	Conservative	Recovery	MRI/angio	Yes
21. Kyriakides, 2007 [25]	M	44	III	T2–T6	5	Surgery	Recovery	MRI/angio	No
22. Braun, 2007 [21]	F	76	I	C2–T6	13	Conservative	Recovery	MRI/angio	No
23. Braun, 2007 [21]	F	72	III	Clivus–L4	24	Conservative	Recovery	MRI/angio	No
24. Ozdemir, 2008 [26]	M	50	II	T4–T8	5	Surgery	Recovery	MRI/angio	No
25. Al, 2009 [39]	M	57	II	T9 - L1	5	Conservative	Recovery	MRI	No
26. Oh, 2009 [40]	F	59	II	C3–C6	4	Conservative	Recovery	MRI	No
27. Kakitsubata, 2010 [41]	M	66	I	T11–T12	2	Conservative	Recovery	MRI/angio <sup>b</sup>	Yes
28. Yang, 2011 [42]	F	55	II	C2–T6	12	Conservative	Recovery	MRI	No
29. Yang, 2011 [42]	M	38	II	C6–T5	7	Conservative	Recovery	MRI	No
30. Panciani, 2013 [43]	F	79	III	C5–T6	9	Surgery <sup>a</sup>	Recovery	MRI	No
31. Chung, 2014 [44]	F	66	I	C7–T4	5	Conservative	Recovery	MRI	No
32. Visocchi, 2015 [45]	F	45	III	T1–T10	10	Surgery	Recovery	MRI	No
33. Zhu, 2015 [46]	F	45	III	T9	1	Surgery	Recovery	MRI/angio	No
34. Ma, 2015 [47]	F	29	II	C6–T2	4	Conservative	Recovery	MRI	No
35. Cui, 2015 [48]	M	45	II	L4–S3	5	Surgery	Recovery	MRI	No
36. Wang, 2018 [49]	M	43	II	C2–C5	4	Surgery	Recovery	CT/MRI	No
37. Present case	F	82	II	T10–L2	5	Surgery	Recovery	MRI/angio	Yes

Grade 0: normal; I: weakness, pain and/or mild hypoesthesia; II: invalidating paresis and level of hypoesthesia; III: abolished motor and sensory capacities (according to Domenicucci et al. [1]).

<sup>a</sup> Delayed surgery after conservative treatment.

<sup>b</sup> The patient declined the angiography.

should be performed in selected cases, according to the risk/benefit balance [1].

### 3. Conclusion

When clinical presentation suggests a spinal cord compression due to a spinal hematoma, MRI appears to be the gold standard and should be performed in emergency in order to confirm the hematoma, its localization, and, if possible, to disclose any underlying lesion.

The main difficulty in diagnosis consists of remembering such a rare entity when there is no history of anticoagulant treatment or previous traumatic procedure.

The clinical outcome depends on the severity of neurological impairment. Surgery could be performed in grade II patients (ASIA C or B) with good results and should especially be proposed in grade III patients (ASIA A) as it tends to be superior to conservative treatment in these cases.

### Contributions

CJ: writing and design of the article, accepts responsibility for conduct of research and final approval. AS: collecting data and drafting the manuscript, accepts responsibility for conduct of research and final approval. SG: analysis or interpretation of data, accepts responsibility for conduct of research and final approval. AD: critical revision of the manuscript for important intellectual

content, accepts responsibility for conduct of research and final approval.

### Disclosure of interest

The authors declare that they have no competing interest.

### References

- [1] Domenicucci M, Ramieri A, Paolini S, Russo N, Occhiogrosso G, Di Biasi C, et al. Spinal subarachnoid hematomas: our experience and literature review. *Acta Neurochir (Wien)* 2005;147(7):750 [741–50; discussion].
- [2] Hung KS, Lui CC, Wang CH, Wang CJ, Howng SL. Traumatic spinal subdural hematoma with spontaneous resolution. *Spine (Phila Pa 1976)* 2002;27(24):E534–8.
- [3] Pereira BJ, de Almeida AN, Muio VM, de Oliveira JG, Holanda CV, Fonseca NC. Predictors of outcome in nontraumatic spontaneous acute spinal subdural hematoma: case report and literature review. *World Neurosurg* 2016;89:574–577 [e7].
- [4] Barker GL. Spinal subdural haematoma following spinal anaesthesia. *Anaesthesia* 1988;43(8):664–5.
- [5] Ng PY. Schwannoma of the cervical spine presenting with acute haemorrhage. *J Clin Neurosci* 2001;8(3):277–8.
- [6] Domenicucci M, Signorini P, Strzelecki J, Delfini R. Delayed post-traumatic epidural hematoma. A review. *Neurosurg Rev* 1995;18(2):109–22.
- [7] Bernsen RATU, Hoogenraad. A spinal haematoma occurring in the subarachnoid as well as in the subdural space in a patient treated with anticoagulants. *Clin Neurol Neurosurg* 1992;94(1):35–7.
- [8] Domenicucci M, Ramieri A, Ciappetta P, Delfini R. Nontraumatic acute spinal subdural hematoma: report of five cases and review of the literature. *J Neurosurg* 1999;91(1 Suppl):65–73.

- [9] Morandi X, Riffaud L, Chabert E, Brassier G. Acute nontraumatic spinal subdural hematomas in three patients. *Spine (Phila Pa 1976)* 2001;26(23):E547–51.
- [10] Rader JP. Chronic subdural hematoma of the spinal cord: report of a case. *N Engl J Med* 1955;253(9):374–6.
- [11] Ainslie JP. Paraplegia due to spontaneous extradural or subdural haemorrhage. *Br J Surg* 1958;45(193):565–7.
- [12] Anagnostopoulos DI, Gortvai P. Spontaneous spinal subdural haematoma. *Br Med J* 1972;1(5791):30.
- [13] Banach S. Spontaneous subdural hematoma of the spinal cord. *Neurol Neurochir Pol* 1970;4(2):243–6.
- [14] Grobovschek M, Schurich H. Spinal subdural space-occupying lesions—hematomas. *Rofo* 1989;150(1):20–5.
- [15] Levy JM. Spontaneous lumbar subdural hematoma. *AJNR Am J Neuroradiol* 1990;11(4):780–1.
- [16] Reynolds Jr AF, Turner PT. Spinal subdural hematoma. *Rocky Mt Med J* 1978;75(4):199–200.
- [17] Sakata TA, Kurihara. Spontaneous spinal subdural hematoma. A case report. *Spine (Phila Pa 1976)* 1984;9(3):324–6.
- [18] Schwartz FT, Sartawi MA, Fox JL. Unusual hematomas outside the spinal cord. Report of two cases. *J Neurosurg* 1973;39(2):249–51.
- [19] Grunberg A, Carlier R, Bekkali F, Silva M, Chemouilli P, Doyon D. Spinal subdural hematoma. Presentation of 2 cases studied with MRI. *J Radiol* 1993;74(5):291–5.
- [20] Kirsch EC, Khangure MS, Hothouse D, McAuliffe W. Acute spontaneous spinal subdural haematoma: MRI features. *Neuroradiology* 2000;42(8):586–90.
- [21] Braun P, Kazmi K, Nogues-Melendez P, Mas-Estelles F, Aparici-Robles F. MRI findings in spinal subdural and epidural hematomas. *Eur J Radiol* 2007;64(1):119–25.
- [23] Barreras P, Heck D, Greenberg B, Wolinsky JP, Pardo CA, Gailloud P. Analysis of 30 Spinal Angiograms Falsely Reported as Normal in 18 Patients with Subsequently Documented Spinal Vascular Malformations. *AJNR Am J Neuroradiol* 2017;38(9):1814–9.
- [22] Mull M, Nijenhuis RJ, Backes WH, Krings T, Wilmink JT, Thron A. Value and limitations of contrast-enhanced MR angiography in spinal arteriovenous malformations and dural arteriovenous fistulas. *AJNR Am J Neuroradiol* 2007;28(7):1249–58.
- [24] Takai K, Usui M. Spontaneous thrombosis of a spinal conus perimedullary arteriovenous fistula. Case report. *Neurol Med Chir (Tokyo)* 2012;52(2):103–6.
- [25] Kyriakides AE, Lalam RK, El Masry WS. Acute spontaneous spinal subdural hematoma presenting as paraplegia: a rare case. *Spine (Phila Pa 1976)* 2007;32(21):E619–22.
- [26] Ozdemir O, Calisaneller T, Yildirim E, Caner H, Altinors N. Acute spontaneous spinal subdural hematoma in a patient with bilateral incarcerated inguinal hernia. *Joint Bone Spine* 2008;75(3):345–7.
- [27] Mattei TA, Rehman AA, Dinh DH. Acute spinal subdural hematoma after vertebroplasty: a case report emphasizing the possible etiologic role of venous congestion. *Global Spine J* 2015;5(5):e52–8.
- [28] Takai K, Kin T, Oyama H, Shojima M, Saito N. Three-dimensional angioarchitecture of spinal dural arteriovenous fistulas, with special reference to the intradural retrograde venous drainage system. *J Neurosurg Spine* 2013;18(4):398–408.
- [29] Thron A, Krings T, Otto J, Mull M, Schroeder JM. The transdural course of radicular spinal cord veins—a microangiographical and microscopical study. *Clin Neuroradiol* 2015;25(4):361–9.
- [30] Song TJ, Lee JB, Choi YC, Lee KY, Kim WJ. Treatment of spontaneous cervical spinal subdural hematoma with methylprednisolone pulse therapy. *Yonsei Med J* 2011;52(4):692–4.
- [31] Krishnan P, Banerjee TK. Classical imaging findings in spinal subdural hematoma - “Mercedes-Benz” and “Cap” signs. *Br J Neurosurg* 2016;30(1):99–100.
- [32] Martinez R, Vaquero J, Gilsanz F. Spontaneous spinal subdural hematoma. Case report. *J Neurosurg Sci* 1987;31(3):157–8.
- [33] Jacquet G, Godard J, Orabi M, Sonmez S, Steimle R. Spinal subdural hematoma. *Zentralbl Neurochir* 1991;52(3):131–5.
- [34] Longatti PL, Freschi P, Moro M, Trincia G, Carteri A. Spontaneous spinal subdural hematoma. *J Neurosurg Sci* 1994;38(3):197–9.
- [35] Kang HS, Chung CK, Kim HJ. Spontaneous spinal subdural hematoma with spontaneous resolution. *Spinal Cord* 2000;38(3):192–6.
- [36] Kuker W, Thies R, Friese S, Freudenstein D, Reinges MH, Ernemann U, et al. Spinal subdural and epidural haematomas: diagnostic and therapeutic aspects in acute and subacute cases. *Acta Neurochir (Wien)* 2000;142(7):777–85.
- [37] Boukobza M, Haddad D, Boissonet M, Merland JJ. Spinal subdural haematoma: a study of three cases. *Clin Radiol* 2001;56(6):475–80.
- [38] Yamada K, Nakahara T, Yamamoto K, Muranaka T, Ushio Y. Nontraumatic spinal subdural haematoma occurring in a postpartum period. *Acta Neurochir (Wien)* 2003;145(2):155 [151–5; discussion].
- [39] Al B, Yildirim C, Zengin S, Genc S, Erkutlu I, Mete A. Acute spontaneous spinal subdural haematoma presenting as paraplegia and complete recovery with non-operative treatment. *BMJ Case Rep* 2009.
- [40] Oh SH, Han IB, Koo YH, Kim OJ. Acute spinal subdural hematoma presenting with spontaneously resolving hemiplegia. *J Korean Neurosurg Soc* 2009;45(6):390–3.
- [41] Kakitsubata Y, Theodorou SJ, Theodorou DJ, Miyata Y, Ito Y, Yuki Y, et al. Spontaneous spinal subarachnoid hemorrhage associated with subdural hematoma at different spinal levels. *Emerg Radiol* 2010;17(1):69–72.
- [42] Yang NR, Kim SJ, Cho YJ, Cho DS. Spontaneous resolution of nontraumatic acute spinal subdural hematoma. *J Korean Neurosurg Soc* 2011;50(3):268–70.
- [43] Panciani PP, Cornali C, Agnoletti A, Esposito G, Ronchetti G, Fontanella M. Recovery after delayed surgery in a case of spinal subdural hematoma. *Case Rep Neurol Med* 2013;3108:54.
- [44] Chung J, Park IS, Hwang SH, Han JW. Acute spontaneous spinal subdural hematoma with vague symptoms. *J Korean Neurosurg Soc* 2014;56(3):269–71.
- [45] Visocchi M, La Rocca G, Signorelli F, Roselli R, Jun Z, Spallone A. 10 Levels thoracic no-instrumented laminectomy for huge spontaneous spinal subdural hematoma removal. Report of the first case and literature review. *Int J Surg Case Rep* 2015;15:57–62.
- [46] Zhu YJ, Peng DQ, Shen F, Wang LL, Tang ZX, Zhang JM. Spontaneous thoracic ventral spinal subdural hematoma mimicking a tumoral lesion: a case report. *J Med Case Rep* 2015;9:132.
- [47] Ma Z, Fang F, Chui KL, Chen T, Cheng XG, Yu CM, et al. A Rare Etiology of Severe Acute Heart Failure: Subacute Spinal Subdural Hematoma in a Young Woman. *Int J Cardiol* 2015;195:61–3.
- [48] Cui Z, Zhong Z, Wang B, Sun Q, Zhong C, Bian L. Coexistence of spontaneous spinal and undiagnosed cranial subdural hematomas. *J Craniofac Surg* 2015;26(2):e118–9.
- [49] Wang Y, Zheng H, Ji Y, Lu Q, Li X, Jiang X. Idiopathic spinal subdural hematoma: case report and review of the literature. *World Neurosurg* 2018;116:378–82.