

CASE REPORT

# Nontraumatic spinal subdural hematoma complicating direct factor Xa inhibitor treatment (rivaroxaban): a challenging management

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## Abstract

**Purpose** We report on a 72-year-old male patient who developed a nontraumatic spinal subdural hematoma (SSDH) during rivaroxaban therapy, a relatively new orally administered direct factor Xa inhibitor.

**Case description** The patient sustained a sudden onset of interscapular pain, followed by gait impairment and paraplegia. Magnetic resonance imaging (MRI) of the spine demonstrated SSDH from T6 to T8. Laboratory tests revealed a high rivaroxaban level, associated with a major hemorrhagic risk. Surgery was, therefore, performed the following morning, after normalization of coagulation parameters.

**Conclusion** Determining the time of safe surgery remains challenging when hemorrhagic complications happen with direct factor Xa inhibitor, especially when neurological prognosis is engaged. Spinal subdural hematoma has not previously been reported following rivaroxaban therapy.

**Keywords** Spinal subdural hematoma · Spine surgery · Factor Xa inhibitor · Rivaroxaban · Spinal cord

## Introduction

Spinal subdural hematoma is a rare entity (about 3 % of all spinal hematomas), and far less frequent than spinal epidural hematoma or subarachnoid hemorrhage [1].

The well-known limitations of vitamin K antagonists (VKA) in clinical practice, especially the need for frequent laboratory monitoring (INR), have led to develop new oral anticoagulants that do not require that burdensome monitoring. Rivaroxaban is a new orally administered direct factor Xa inhibitor and is increasingly prescribed. The targeting of factor Xa, key component in the coagulation cascade, has the benefit of being an effective antithrombotic therapy with a lesser potential risk of bleeding, both highly dose-dependent. Nevertheless, complications may occur, and spinal epidural hematoma complicating rivaroxaban medication has already been described [2].

We report here the first case to our knowledge of non-traumatic spinal subdural hematoma (SSDH) complicating rivaroxaban therapy.

## Case report

A 72-year-old man was admitted in our institution 24 h after an interscapular pain of sudden onset associated with rapidly worsening gait impairment. He had received rivaroxaban(20 mg per day) for 3 years for an atrial fibrillation. This medication has been chosen in order to avoid monitoring of INR. His latest intake was the day before symptoms onset. Clinical examination found a flaccid paraplegia with bilateral Babinski sign, thermoalgetic hypoesthesia predominantly on the left inferior limb, with a T6 sensitive level. Knee and ankle reflexes were absent bilaterally. Rectal examination showed a decreased anal tone.

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Spinal MRI showed on sagittal slices the presence of heterogeneous signal intensity consistent with blood, possibly subdural, from T6 to T8 (Fig. 1a, b). Axial slices (Fig. 1c) showed an aspect of inner lobulations, with right anterolateral predominance, and associated posterior and lateral displacement of the spinal cord. No abnormal signal of the spinal cord was present. Epidural fat was conserved. Diagnosis of subdural spinal thoracic hematoma from T6 to T8 was made. Neither MR angiography of the cranial arteries and veins nor spinal MRI showed any vascular malformation.

Laboratory tests revealed a rivaroxaban level (with a chromogenic testing of anti-Xa plasmatic activity) at 331 ng/ml [ $C_{max}$  ranges (mean values) from 40 ng/ml to 400 ng/ml], an activated clotting time (ACT) at 31.6, and a prothrombin time (PT) at 50 %.

2 h after the initial dosage of plasmatic rivaroxaban, neurologic deficit was unchanged and second dosage still showed a high level (301 ng/ml) associated with a high per-procedural hemorrhagic risk. The surgery was delayed and coagulation parameters were first normalized with prothrombin complex concentrate (PCC).

Surgery was performed the following morning with a rivaroxaban level of 127 ng/ml. A thoracic laminectomy was carried out from T6 to T8, with dura-matter opening at these levels. An intradural collected hematoma was immediately visible (Fig. 2), and loosed from the dentate ligament and nerve roots. After evacuation of the hematoma, the spinal cord appeared normal. There was no evidence of any vascular malformation or neoplasm.

Patient was treated with intravenous corticosteroids after surgery. He also received physical and occupational therapy throughout his hospital stay. However, despite surgery and appropriate rehabilitation, the patient had neither motor nor sensitive improvement after 6 months of follow-up.



**Fig. 2** Operative view with dura opening showing the subdural collected hematoma

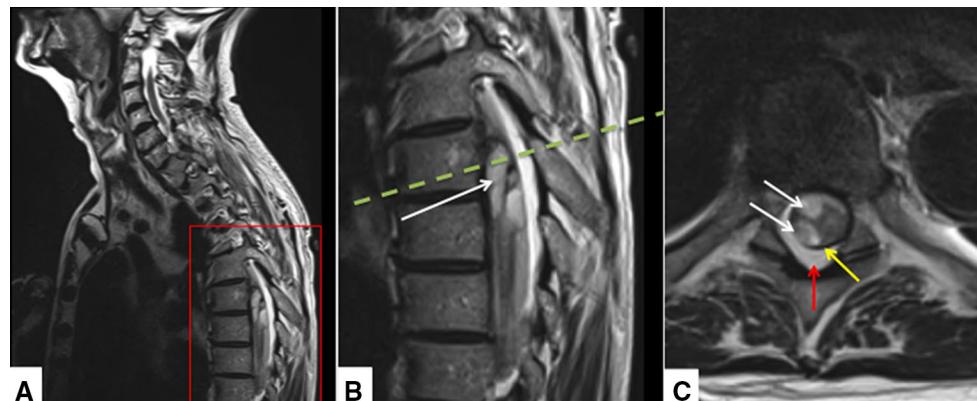
Final diagnosis was spinal subdural hematoma complicating rivaroxaban therapy, based on symptoms and signs that were supported by radiological, biological and surgical findings.

## Discussion

Although spontaneous/nontraumatic SSDH are sometimes reported in the literature, they are rare in clinical practice [3].

Symptoms of SSDH include sudden-onset back pain, sometimes radiating to the limbs or trunk, weakness, numbness, and urinary or fecal incontinence. Autonomic disturbances can be present [4].

Anatomical data, such as definition of the anatomical spaces in the spinal canal, give reliable clues to diagnose lesions related to spinal compartments and help for the radiological diagnosis of SSDH. Thus, subdural hematoma is contained by dura, don't encroach epidural fat, may contain inner lobulations and displace nerve roots. It occurs most commonly at the thoracic level. T1 and T2 signal is



**Fig. 1 a, b** (Sagittal T2 sequence) Demonstrate the subdural hematoma (white arrow) extending from approximately T6–T8 levels, mainly in high signal, associated with a rim of hypointensity. **c** (Axial T2 sequence corresponding to green dot line) shows aspect

of inner lobulations (white arrows), with right anterolateral predominance, and associated posterior and lateral displacement of the spinal cord. Epidural fat (red arrow) is clearly delineated and separated from the hematoma by the dural layer (yellow arrow)

variable, depending on the age of the hematoma [5]. The hematoma at the acute stage can have the same signal as the cerebrospinal fluid, so T2-weighted images can be misleading. Subdural hematomas generally extent more crano-caudally than epidural ones, the latter being usually over 2–3 vertebrae long [6]. They tend to demonstrate a crescent shape, but biconvex, circumferential or mixtures of shapes are possible. The Mercedes-Benz sign corresponds to an encasement of the filum terminale and exiting nerve roots, resulting in a star-like appearance, when SSDH interests lumbar region [7]. Sometimes, spinal subdural hematoma in the subacute phase can mimics spinal epidural lipomatosis on MRI, with high signal intensity on both T1- and T2-weighted images [8]. Fat-suppressed T1-weighted is helpful in these cases. Whereas epidural hematoma displaces dura, may have a lentiform or convex aspect, effaces epidural fat and contacts bone. On the sagittal views, “cap” of epidural fat is sometimes visible at upper and lower margins. Gadolinium enhancement at the acute stage is possible [9].

Subarachnoid collections may present with fluid–fluid levels on axial views, with traversing nerves through collection.

No consensus exists concerning management of patients under new antithrombotic medication needing urgent surgery. In our case, waiting for a second plasmatic dosage was decided at first, because deficit was stable and rivaroxaban plasmatic level was high. It was then rapidly decided to evacuate surgically the hematoma, to avoid significant clinical worsening, and maybe improving the neurologic deficit.

For planned surgery, proposals of the French Society of Anesthesiology and Reanimation are the following [10]: (1) Rivaroxaban plasmatic concentration of 30 ng/ml is an acceptable security threshold [11], and surgery is possible when patient is below this value. (2) For concentrations between 30 and 200 ng/ml, it is recommended to wait for 12 h and to re-assess rivaroxaban concentration. Patient may benefit surgery if delaying it is not possible, with adjunction of prothrombin complex concentrate (PCC, 25–50 UI/kg) or FEIBA (factor eight inhibitor bypassing activator, 30–50 UI/kg) if bleeding is important during the intervention. (3) For concentrations between 200 and 400 ng/l, it is recommended to retard the surgery as long as possible and to test again plasmatic concentration (12 or 24 h after the first dosage). If the intervention cannot be delayed, antagonisation by PCC (prothrombin complex concentrate, 25–50 UI/kg) or FEIBA (factor eight inhibitor bypassing activator, 30–50 UI/kg) may be useful if there is abnormal bleeding during the intervention. (4) Plasmatic concentration above 400 ng/ml means overdose, with a major bleeding risk, and surgery is not recommended.

When specific dosage of rivaroxaban is not possible, both normal PT and ACT are reliable with a plasmatic concentration below 30 ng/ml. Anti-Xa activity may be helpful too, as activity inferior or equal to 0.1 U/ml traduces absence of active medication.

It is worth noting that the interval from onset of symptoms to surgical intervention is critical for neurological recovery [1]. In our case, it was first decided to wait for a second plasmatic dosage, after PCC administration, because the first one showed a high plasmatic concentration, with serious risk of massive bleeding during surgery. Furthermore, neurologic symptoms were stable. Nevertheless, it was unlikely that patient would improve without evacuation of the hematoma [1], surgery was therefore decided the day following symptoms onset.

## Conclusion

Nontraumatic SSDH must be considered in patients undergoing anticoagulant therapy who have abrupt onset of signs and symptoms of acute spinal cord or cauda equina compression. Determine time of safe surgery remain challenging when hemorrhagic complications happen with direct factor Xa inhibitor, especially when neurological prognosis is engaged.

Finally, antidote reversing rivaroxaban effect would be very useful in case of emergency surgery. New specific molecules (idarucizumab, andexanet alfa, and ciraparantag) show promising data, and may soon become available for clinical use [12].

## Compliance with ethical standards

**Conflict of interest** None of the authors has any potential conflict of interest.

## References

1. Kreppel D, Antoniadis G, Seeling W (2003) Spinal hematoma: a literature survey with meta-analysis of 613 patients. *Neurosurg Rev* 26:1–49. doi:[10.1007/s10143-002-0224-y](https://doi.org/10.1007/s10143-002-0224-y)
2. Jaeger M, Jeanneret B, Schaeren S (2012) Spontaneous spinal epidural hematoma during factor Xa inhibitor treatment (Rivaroxaban). *Eur Spine J* 21:433–435. doi:[10.1007/s00586-011-2003-3](https://doi.org/10.1007/s00586-011-2003-3)
3. Kyriakides AE, Lalam RK, El Masry WS (2007) Acute spontaneous spinal subdural hematoma presenting as paraplegia: a rare case. *Spine* 32:E619–E622
4. Chung J, Park IS, Hwang S-H, Han J-W (2014) Acute spontaneous spinal subdural hematoma with vague symptoms. *J Korean Neurosurg Soc* 56:269–271. doi:[10.3340/jkns.2014.56.3.269](https://doi.org/10.3340/jkns.2014.56.3.269)
5. Kirsch EC, Khangure MS, Holthouse D, McAuliffe W (2000) Acute spontaneous spinal subdural haematoma: MRI features. *Neuroradiology* 42:586–590

6. Fukui MB, Swarnkar AS, Williams RL (1999) Acute spontaneous spinal epidural hematomas. *AJNR Am J Neuroradiol* 20:1365–1372
7. Kasliwal MK, Shannon LR, O'Toole JE, Byrne RW (2014) Inverted Mercedes Benz sign in lumbar spinal subdural hematoma. *J Emerg Med*. doi:[10.1016/j.jemermed.2014.07.058](https://doi.org/10.1016/j.jemermed.2014.07.058)
8. Kamo M, Watanabe Y, Numaguchi Y, Saida Y (2012) Spinal subdural hematoma mimicking epidural lipomatosis. *Magn Reson Med Sci MRMS Off J Jpn Soc Magn Reson Med* 11:197–199
9. Nawashiro H, Higo R (2001) Contrast enhancement of a hyperacute spontaneous spinal epidural hematoma. *Am J Neuroradiol* 22:1445
10. Management of major bleeding complications and emergency surgery in patients on long-term treatment with direct oral anticoagulants, thrombin or factor-Xa inhibitors. Proposals of the Working Group on Perioperative Haemostasis (GIHP), March 2013.pdf
11. Patel MR, Mahaffey KW, Garg J et al (2011) Rivaroxaban versus warfarin in nonvalvular atrial fibrillation. *N Engl J Med* 365:883–891. doi:[10.1056/NEJMoa1009638](https://doi.org/10.1056/NEJMoa1009638)
12. Enriquez A, Lip GYH, Baranchuk A (2015) Anticoagulation reversal in the era of the non-vitamin K oral anticoagulants. *Eur Eur Pacing Arrhythm Card Electrophysiol J Work Groups Card Pacing Arrhythm Card Cell Electrophysiol Eur Soc Cardiol*. doi:[10.1093/europace/euv030](https://doi.org/10.1093/europace/euv030)