

CASE REPORT

Particularities of clinical onset and favorable evolution towards functional neurorehabilitation in a very large post-acenocoumarol overdose hematoma (C7-T10) —a case report

Aura Spinu^{1,2,†}, Cristina Daia^{1,2,†}, Cristina Popescu^{2,*†}, Ioana Andone^{1,2,†},
Theodora Ionescu^{2,†}, Ana Cristea^{2,†}, Mihai Baila^{2,†}, Costica Zamfir^{3,†}, Gelu Onose^{1,2,†}

¹Physical and Rehabilitation Medicine Department, Faculty of Medicine, University of Medicine and Pharmacy "Carol Davila", 020021 Bucharest, Romania

²The Neuromuscular Rehabilitation Clinic Division, Teaching Emergency Hospital "Bagdasar-Arseni" (TEHBA), 041915 Bucharest, Romania

³The Neurosurgery II Clinic Division, Teaching Emergency Hospital "Bagdasar-Arseni" (TEHBA), 041915 Bucharest, Romania

***Correspondence**

cristina_popescu_recuperare@yahoo.com
(Cristina Popescu)

† These authors contributed equally.

Abstract

Introduction: The incidence of spontaneous spinal epidural hematoma is relatively rare and it may cause a spinal cord injury possibly associated with related severe disabling conditions: sensory-motor impairments, back pain, neurogenic bladder and bowel. The MRI is the golden standard diagnostic examination in patients suspected of spinal epidural hematoma. Still, such a spontaneous condition can be, not-seldom, asymptomatic.

Materials and methods: This paper presents the case of a 79-year-old male patient with permanent atrial fibrillation, treated with acenocoumarol, who was admitted, first in the General Surgery Clinic Division with rectal tenesmus and acute urinary retention and, subsequently developed a sudden onset of motor deficit, as presented in the body text. The patient was diagnosed with epidural hematoma (C7-T10) resulting in AIS/Frankel C paraplegia, with T10 neurological level. The positive and differential diagnoses concluded that the acenocoumarol overdose was the main etiopathogenic factor.

Results: The patient—being promptly transferred to the Spinal Neurosurgical Clinic Division—received conservative treatment, followed by a neuro-muscular rehabilitation program achieved in our Neuro-Rehabilitation Clinic Division, with mainly favorable outcomes: at discharge he was able to walk independently on short distances.

Conclusions: The clinical outcomes and quality of life of patients suffering from spinal epidural hematoma depend on the fast diagnosis and efficient acute neurosurgical/conservative treatment, followed by an appropriate rehabilitation program, including with medium and long term medical follow-up. This clinical case has received the Teaching Emergency Hospital "Bagdasar-Arseni" Bioethics Committee approval No. 27/1935-25.02.2021.

Keywords

Spinal epidural hematoma; Neurorehabilitation; Acenocoumarol overdose; Neurologic deficit; Neurogenic bladder

1. Introduction

Non-traumatic spinal epidural hematoma (SEH) are defined as presence of blood in the epidural space, with an estimated incidence of 0.1 in 100,000 per year, often associated with coagulopathies, anticoagulation therapy, hypertension, old ages and/or arteriovenous malformations [1–6]. It is a potentially life-threatening condition and without appropriate management, it may result in a poor prognosis [1]. Prompt diagnosis and adequate therapy and rehabilitation approach are needed in order to prevent or reduce permanent neuro-functional deficits [7, 8]. SEH was described for the first time in the medical literature, in 1682 in the G.J Duverney's "Histoire de L'Academie Royale des Science" [9]. The hematoma is often

asymptomatic, but it can also lead to spinal cord compression, resulting in potentially severe disability [9]. SEH seems to be more symptomatic when it affects the cervical and thoracic spinal cord [9]. A high suspicion of such hematoma is given by the sudden onset of severe back and/or radicular pain, sensory impairments, bladder and bowel dysfunction and motor deficits. The patients describe the pain as severe and exacerbated by touching, coughing or sneezing. The physical impairment can vary from focal weakness in the metameric corresponding innervated limbs (paraplegia or quadriplegia), unilateral or bilateral radicular paresthesia, depending on the level and the size of the lesion [9, 10]. When SEH is suspected, even in the absence of risk factors for hemorrhage,

the rapid imagistic evaluation, mainly magnetic resonance imaging (MRI) is required [8, 9], providing physicians with essential information on the location, stage of hematoma evolution, and the degree of spinal cord compression [9]. The standard approach of SEH is prompt decompression of the neural structures with the removal of the hematoma, either surgically or conservatively, which aim to result in significant neurological improvement. Non-operative therapy is also been considered but there are no evidence-based guidelines regarding the optimal conservative treatment of the SEH, although it always has to be a well-documented and balance decision in this respect [11–16]. The case will be presented further is just an example of a very correct, professional neuro-surgical decision of non-intervention, which proved to be an adequate option.

2. Case presentation

Having the patient's consent and the approval of the Ethics Commission of the Teaching Emergency Hospital "Bagdasar-Arseni" No. 27/1935-25.02.2021, this paper presents the case of a 79-year-old male patient living in a rural area, with history of permanent anticoagulant therapy with acenocoumarol for atrial fibrillation. Other comorbidities included right bundle branch block, primary hypertension, iron deficiency anemia and nitrogen retention. The patient was first admitted in the General Surgery Clinic Division of our hospital for rectal tenesmus and acute urinary retention. The patient had no recent history of local, regional or poly-trauma. To be mentioned that at the presentation in the emergency room, the patient's coagulation tests parameters (INR, APTT, PT and fibrinogenemia) were so high, that they were undetectable. The first therapeutic intervention was the interruption of the acenocoumarol therapy. After two days of hospitalization in the General Surgery Clinic, the coagulation tests quasi-normalized except for the fibrinogenemia—which remain higher than normal for another about 4 weeks—(INR = 1.27, PT = 17.3 s – normal range = 0.85–1.15 s, APTT = 20.5 s – normal range = 24.3–35 s). The quasi-concomitant onset/progression of neuro-motor deficit in the lower extremities required the transfer of the patient in the Spinal Neurosurgery Clinic Division of our hospital. An MRI examination was performed for the diagnosis of a potential spinal cord lesion. This showed a massive cervical and thoracic epidural hematoma (C7-T10), without other local or regional vascular abnormalities. The positive diagnosis was established: spontaneous cervical and thoracic SEH. The differential diagnosis concluded that it was most probably caused by an acenocoumarol anticoagulant overdose. Under these circumstances, the spinal cord neurosurgeons decided to continue monitoring the coagulation tests and the spinal cord MRI. Regarding the criteria for surgery, the reasons for restrain and thus the choice of the less frequent intervention modality (i.e., the conservative one), have been the very important precautions caused by the etiology of the SEH (i.e., coumarone overdose). The intraoperative risk of severe bleeding (especially considering the patient at admission in the neurosurgical ward presented a not detectable INR) was an undesirable complication. The patient had a stationary neurological evolution without the increase of the neurologic

deficit and the coagulation parameters normalized. The first MRI control done in the seventh day of hospitalization in the Spinal Neurosurgery Clinic Division showed reductions almost by half of the SEH thickness (Fig. 1). The decision for choosing the conservative treatment alternative proved appropriate and successful. The neurosurgeons together with the neuro-rehabilitation physicians decided to continue the monitoring of the patient together with deploying a neuromuscular rehabilitation program.

At the admission in the Neuromuscular Rehabilitation Clinic Division of our hospital the patient had a good general state, and was respiratory and hemodynamically stable. The neuro-function examination revealed an American Spinal Injury Association Impairment Scale (AIS)/Frankel C paraplegia with hypoesthesia below T10 dermatome level, impaired balance control and neurogenic bladder of retention type, that required an indwelling catheterization. Functionally the patient was able to maintain a sitting position at the bed side. On the course of one month the patient followed a complex rehabilitation program (RP). He was functionally assessed according to the standardized protocols implemented in our Clinic Division, using the following scales [17] (Table 1): AIS/(Frankel) [18], Spinal Cord Independency Measure II (SCIM) [19]; Walking Index Spinal Cord Injury (WISCI) [20]; Functional Ambulation Categories (FAC) International Scale [21]; Modified Ashworth scale [22]; Life Quality Assessment after Flanagan (QoL) [23].

During hospitalization, the patient underwent a complex approach program, consisting of rehabilitation nursing [24]—according to the related needing, all over the day—pharmacological treatment and physical therapy, with in-bed mobilization, active exercise sessions and standing and gait re-training.

(1) Rehabilitation nursing consisting of monitoring for possible complications (most often potentially occurring in SCI patients: trachea-bronchial stasis, peripheral venous-lymphatic circulation impairment, urinary bladder and bowel dysfunction, articular deformation/poor posture and pressure sores). Although the motor recovery had a good/very good progress, in a short length of stay (considering the well-known, in principle unfortunate tendency to long-term or even for life, severe disability after SCI), the patient, yet, encountered—still at present—symptoms of neurogenic bladder, mainly of retention type and as consequent complication: lower urinary tract infection (UTI). Accordingly, a part of the rehabilitation nursing entailed the attempt to test and promote the micturition control regain through extracting the indwelling catheter and starting intermittent catheterization (IC)—haplessly the actual “gold standard” in the management of neurogenic bladder [25]. Due to the discomfort claimed by the patient during intermittent catheterization because of a slight residual irritation of the distal part of the urinary meatus and considering an acute episode of UTI (febrile) it had been necessary to return to indwelling catheterization. However, the meatus irritation—as well as the UTI episode—resolved. At discharge, the patient has been recommended to visit a urologist and we had been informed by phone (as we remained in connection with the patient and his kin) that following this consultation, aside keeping the indwelling catheter and

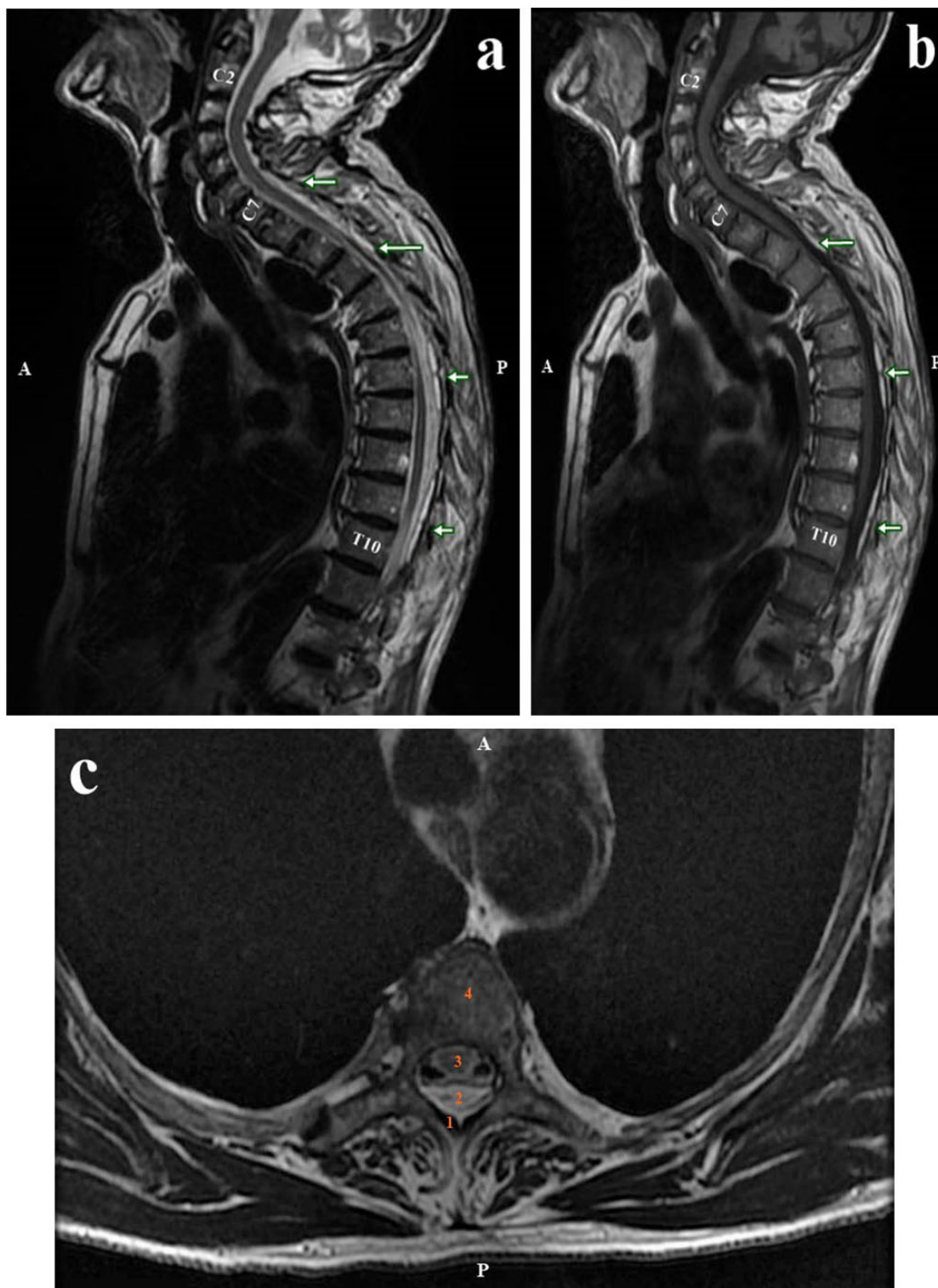


FIGURE 1. The MRI control examination performed 7 days after the first MRI investigation. The sagittal plane T2W (a) and T1W (b) images show the presence of a cervical and thoracic spinal cord hematoma extended from C7 to T10 vertebrae (white-green arrows). The axial plane T2W (c) image shows the epidural hematoma compressing the spinal cord. (c) 1, Ligamentum flavum; 2, Epidural hematoma; 3, Spinal cord; 4, Vertebral body. A, anterior; P, posterior.

continuing antibiotic therapy for another month, there have been considered no other treatments necessary in this respect.

(2) The pharmacological treatment aimed and achieved bridging anticoagulation that is the acenocoumarol therapy cessation. Anticoagulation has been continued with low molecular weight heparin at prophylactic dose and in the last

week of the patient hospitalization, following the thorough and iterative consultation and recommendation of the cardiologist the anticoagulant medication at least on medium term has been decided to consist of administration of novel oral anticoagulant therapy (NOAC) for atrial fibrillation, according to the 2021 European Heart Rhythm Association related practical guide

TABLE 1. Evaluation scales applied to patients with SCI in the NMR Clinic Division—with their values at admission.

Evaluation scales—scores at admission	Value
Motor AIS	80/100 points
Sensory AIS	176/224 points
SCIM II	42/100 points
WISCI	13/20
FAC	2/5
Modified Ashworth scale	0/4 points (no spasticity)
QOL	64/112 points

TABLE 2. Evaluation scales applied to patients with SCI in our neuro-muscular Clinic Division—with their values at discharge.

Evaluation scales-scores at discharge	Value
Motor AIS	90/100 points
Sensory AIS	204/224 points
SCIM II	75/100 points
WISCI	19/20
FAC	4/5
Modified Ashworth scale	0/4 points (no spasticity)
QOL	96/112 points

[26]. Other pharmaceutical agents used in this case were: analgesics, neurotrophic drugs, calcium-ion channel blockers, class II antiarrhythmic beta-blockers antibiotic therapy according to the antibiogram, and urinary antiseptics.

(3) Physical therapy: Before complete verticalization the patient underwent passive/active in bed joints mobilisation exercise along with appropriate positioning of the body alignment, in order to combat bed-rest over an usual duration and its potential complications (specifically in this case including muscle hypotrophy induced by the neurologic deficit—and constipation) [27].

After achieving orthostatic position, the patient was assisted and instructed to perform wheelchair transfers and followed exercise sessions with various assistive tools: motor-supported cycle ergometer, roller device, pedal exerciser, stall bars. The main objectives were the improvement of strength and control of the trunk and limbs and the restoration of a standing and gait abilities. Walking exercises were performed in the first stage between parallel bars with full support from the physical therapist and in the next stage with walking frame and crutches.

3. Results

The patient had a single admission in our Neuromuscular Clinic Division, with a length of stay of 22 days and following a complete rehabilitation program of 17 days (except for the not-working days: Saturday, Sunday), and benefited from a multidisciplinary team evaluation and therapeutic-nursing-rehabilitative interventions. The evolution of the case was favorable, with rapid recovery of orthostatic posture and control and the increase of muscle strength following the early complex neuro-muscular rehabilitation program. At discharge the patient managed to walk with unilateral support in one Lof-

strand type crutch, including climbing/descending a few stairs, even completely unassisted on flat ground, for several meters. The neuro-functional and QOL improvement were quantified dynamically (admission vs. discharge—Table 2). Also the MRI control examination was performed at discharge (Fig. 2) in order to describe and compare the primary lesion. The results showed the complete resorption of the spinal epidural hematoma. At the present time the patient achieved to re-adapt to his social environment (Fig. 3).

4. Discussion

We have chosen to report this case in order to highlight, on one hand the huge disabling potential of any spinal cord lesion—no matter the etiology, including a compressive epidural hematoma (to be seen that, in our case despite the very good somatic motor evolution, elements of neurogenic bladder still remained)—and on the other, that a very professional and balanced decision regarding the supplementary intrinsic (and they are not few) surgical risks, especially on such a delicate structure as the spinal cord, a conservative attitude is never easy to be assumed and taken; this is because abstaining from the surgical intervention entails no less risks, especially considering—as we have pointed out in the paper—the operative option is by far more frequently taken into account, actually being the standard management. The early outcome in this case was positive, mostly due to a prompt, correct and efficient diagnostic and conservative treatment, as the spinal epidural hematoma did not need surgical intervention, with the hematoma completely resorbing. Furthermore, the neuromuscular rehabilitation program managed to improve the functionality of the patient, from a state of bed rest and reduced muscle strength to one of walking autonomy and

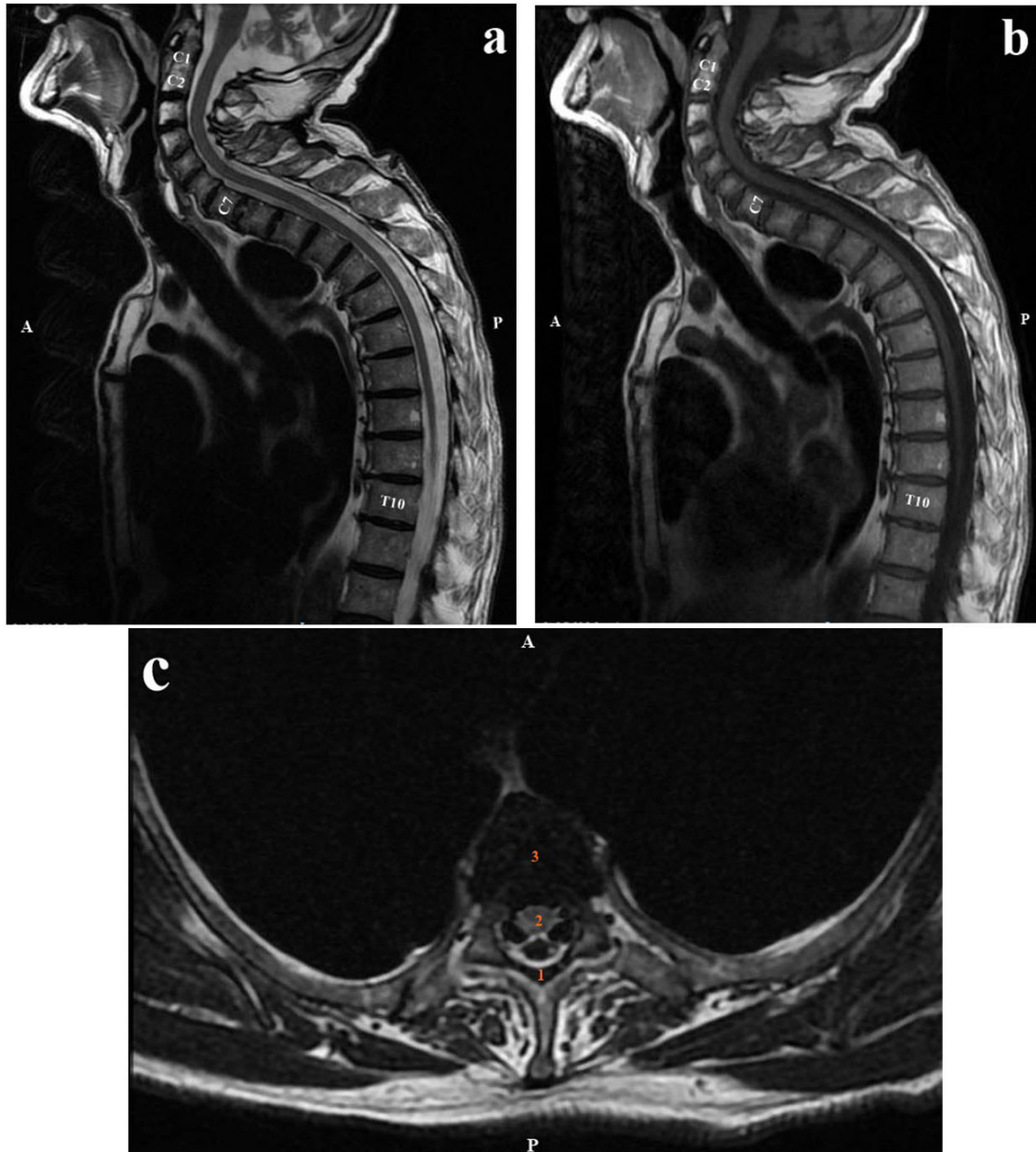


FIGURE 2. The MRI examination performed at discharge. The sagittal plane T2W (a), T1W (b) and the axial plane T2W (c) images, all show a complete regression of the spinal epidural hematoma. (c) 1, Ligamentum flavum; 2, Spinal cord; 3, Vertebral body. A, anterior; P, posterior.

well supported exercise reconditioning. Actually, the principal health problem of the patient remained the neurogenic bladder, mainly of retention type, for which he must keep the indwelling catheter at least for one month. Therefore, the basic recommendation, specifically in this case, is prevention of the urinary tract infections relapsing and the attempt to eliminate the actual urine evacuation mode, i.e., to progress either to intermittent catheterization or hopefully to the (spontaneous or specific training based), normal micturition control. This will obviously need a new hospitalization to achieve this goal under medical—clinical and urodynamic—surveillance and therapy.

We also recommend the continuation of the rehabilitation program—adapted to the present functional status of the patient, including in consideration of its cardiologic conditions—to prevent possible future complications, as neuromuscular deconditioning and/or neuropathic pain, and general endurance

decline.

Anticoagulation has been continued with low molecular weight heparin and in the last week of the patient hospitalization, following the thorough and iterative consultation and recommendation of the cardiologist the anticoagulant medication at least on medium term has been decided to consist of administration of novel oral anticoagulant therapy for atrial fibrillation—according to the 2021 European Heart Rhythm Association related practical guide [26]. The patient will follow an oral anticoagulant therapy with a new oral anticoagulant drug (Apixaban).

5. Conclusions

Regarding non-traumatic hematomas of the spinal cord, exhaustive clinical evaluation is extremely important, together



FIGURE 3. The patient's clinical evolution. The patient is walking unassisted at home after one month from hospital discharge.

with MRI (which is the imagistic election method, providing useful information about the location, size and etiology of the respective lesion) for early diagnosis.

Improvement of the clinical outcome and QOL in patients suffering from such conditions depend on prompt diagnosis and treatment—entailing very careful and precise decision for surgical or conservative treatment, within a tight collaborative multidisciplinary (Physical Medicine and Rehabilitation, Neurosurgery, Cardiology) approach, followed by an adequate neurorehabilitation program, if remaining neurological disabilities.

Regarding the limitation, we mention that at the time when this article was conceived, a protocol including the criteria for surgical intervention / non-intervention for the treatment of

epidural hematomas was not finalized and implemented in our hospital.

AUTHOR CONTRIBUTIONS

All the listed authors contributed equally to this paper. AS, CD, CP, IA, TI, AC, MB, CZ, GO: conceptualization, study design, methodology preparation, evaluation of the patient, collecting the data about the patient, analyze the data, writing and editing. All authors read and approved the final version of the article.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This research obtained the patient's consent and the approval of the Ethics Commission of the Teaching Emergency Hospital "Bagdasar-Arseni" No. 27/1935-25.02.2021.

ACKNOWLEDGMENT

We would like to thank to all the peer reviewers for their opinions and suggestions.

FUNDING

This study received no external funding.

CONFLICT OF INTEREST

The authors declare no conflict of interest. Cristina Daia, Cristina Popescu, and Gelu Onose are co-Guest Editors of this journal.

REFERENCES

- [1] Figueroa J, DeVine JG. Spontaneous spinal epidural hematoma: literature review. *Journal of Spine Surgery*. 2017; 3: 58–63.
- [2] Bhat K, Kapoor S, Watali Y, Sharma J. Spontaneous epidural hematoma of spine associated with clopidogrel: a case study and review of the literature. *Asian Journal of Neurosurgery*. 2015; 10: 54.
- [3] Babayev R, Ekşi MS. Spontaneous thoracic epidural hematoma: a case report and literature review. *Child'S Nervous System*. 2016; 32: 181–187.
- [4] Bakker NA, Veeger NJGM, Vergeer RA, Groen RJM. Prognosis after spinal cord and cauda compression in spontaneous spinal epidural hematomas. *Neurology*. 2015; 84: 1894–1903.
- [5] Dziedzic T, Kunert P, Krych P, Marchel A. Management and neurological outcome of spontaneous spinal epidural hematoma. *Journal of Clinical Neuroscience*. 2015; 22: 726–729.
- [6] Knipe H, Saber M. Spinal epidural hematoma. 2019 . Available at: <https://radiopaedia.org/articles/spinal-epidural-haematoma> (Accessed: 20 March 2021).
- [7] Khairat A, Waseem M. Epidural Hematoma. 2021. Available at: <https://pubmed.ncbi.nlm.nih.gov/30085524/> (Accessed: 20 March 2021).
- [8] Raouf A, Goyal S, Van Horne N, Traylor J. Spontaneous Spinal Epidural Hematoma Secondary to Rivaroxaban Use in a Patient with Paroxysmal Atrial Fibrillation. *Cureus*. 2020; 12: e10417.
- [9] Nelson A, Benzon HT, Jabri RS. Diagnosis and Management of Spinal and Peripheral Nerve Hematoma. 2017. Available at: <https://www.nysora.com/foundations-of-regional-anesthesia/complications/diagnosis-management-spinal-peripheral-nerve-hematoma/> (Accessed: 20 March 2021).

- [10] Chien C. Spinal Epidural Hematoma. 2006. Available at: <https://coreem.net/core/spinal-epidural-hematoma> (Accessed: 20 March 2021).
- [11] Brawn LA, Bergval UE, Davies-Jones GA. Spontaneous spinal epidural haematoma with spontaneous resolution. *Postgraduate Medical Journal*. 1986; 62: 885–887.
- [12] Duffill J. Can spontaneous spinal epidural haematoma be managed safely without operation? A report of four cases. *Journal of Neurology, Neurosurgery & Psychiatry*. 2000; 69: 816–819.
- [13] Groen RJM. Non-operative treatment of spontaneous spinal epidural hematomas: a review of the literature and a comparison with operative cases. *Acta Neurochirurgica*. 2004; 146: 103–110.
- [14] Pahapill PA, Lownie SP. Conservative Treatment of Acute Spontaneous Spinal Epidural Hematoma. *Canadian Journal of Neurological Sciences*. 1998; 25: 159–163.
- [15] Goyal G, Singh R, Raj K. Anticoagulant induced spontaneous spinal epidural hematoma, conservative management or surgical intervention—a dilemma? *Journal of Acute Medicine*. 2016; 6: 38–42.
- [16] Shin J, Kuh S, Cho Y. Surgical management of spontaneous spinal epidural hematoma. *European Spine Journal*. 2006; 15: 998–1004.
- [17] Onose G, Anghelescu A. Guide to diagnosis, treatment and rehabilitation in spinal cord injuries. Bucharest: “Carol Davila” University Press. 2011. (In Romanian)
- [18] American Spinal Injury Association: International Standards for Neurological Classification of Spinal Cord Injury, revised 2000; Atlanta, GA, Reprinted 2008. ASIA 2019 revision. Available at: https://asia-spinalinjury.org/wp-content/uploads/2019/04/ASIA-ISCOS-IntlWorksheet_2019.pdf (Accessed: 20 March 2021).
- [19] Catz A, Itzkovich M, Tesio L, Biering-Sorensen F, Weeks C, Laramie MT, *et al*. A multicenter international study on the Spinal Cord Independence Measure, version III: Rasch psychometric validation. *Spinal Cord*. 2007; 45: 275–291.
- [20] Dittuno P, Dittuno Jr J. Walking index for spinal cord injury (WISCI II): scale revision. *Spinal Cord*. 2001; 39: 654–656.
- [21] Holden MK, Gill KM, Magliozzi MR *et al*. Clinical gait assessment in the neurologically impaired: reliability and meaningfulness. *Physical Therapy*. 1984; 64: 38–40
- [22] Ashworth B. Preliminary trial of carisoprodol in multiple sclerosis. *Practitioner*. 1964; 192: 540–542.
- [23] Burckhardt CS, Anderson KL. The Quality of Life Scale (QOLS): Reliability, Validity, and Utilization. *Health Qual Life Outcomes*. 2003; 1: 60.
- [24] Hoeman SP. *Rehabilitation Nursing: Prevention, Intervention and Outcomes*. Elsevier Health Sciences. 2008.
- [25] Kavanagh A, Baverstock R, Campeau L, Carlson K, Cox A, Hickling D, *et al*. Canadian Urological Association guideline: Diagnosis, management, and surveillance of neurogenic lower urinary tract dysfunction. *Canadian Urological Association Journal*. 2019; 13:157–176.
- [26] Steffel J, Collins R, Antz M, Cornu P, Desteghe L, Haeusler K, *et al*. 2021 European Heart Rhythm Association Practical Guide on the Use of Non-Vitamin K Antagonist Oral Anticoagulants in Patients with Atrial Fibrillation. *Europace*. 2021; euab065.
- [27] John K, Knight J, Nigam Y. Effects of bedrest 5: The muscles, joints and mobility. *Nursing Times*. 2019; 115: 54–57.

How to cite this article: Aura Spînu, Cristina Daia, Cristina Popescu, Ioana Andone, Theodora Ionescu, Ana Cristea, *et al*. Particularities of clinical onset and favorable evolution towards functional neurorehabilitation in a very large post-acenocoumarol overdose hematoma (C7-T10) —a case report. *Signa Vitae*. 2021;17(5):151-157. doi:10.22514/sv.2021.112.