

Spontaneous resolution of chronic subdural hematoma after resetting the pressure of programmable Ventriculoperitoneal shunt: A case report.

Ali Haider¹, Muhammad Mehboob Alam², Muqaddes Mehraj², Sarah Arshad³, Umer Farooq⁴, Syed Turab Haider⁵, Javed Iqbal⁶, Abdur Rehman⁴, Shahzaib Maqbool⁴, and Rabia Zaheer⁷

¹Hamdard University College of Medicine and Dentistry

²Wah Medical College

³Central Park Medical College

⁴Rawalpindi Medical University

⁵Nishtar Medical University

⁶Hamad Medical Corporation

⁷Liaquat University of Medical and Health Sciences

September 09, 2024

Title : Spontaneous resolution of chronic subdural hematoma after resetting the pressure of programmable Ventriculoperitoneal shunt: A case report.

Authors details:

Ali Haider: aliqqq568@gmail.com

Hamdard medical and dental college, Karachi, PAK.

Muhammad Mehboob Alam: nsmehboob@gmail.com

Wah medical college, Wah Cantt, PAK.

Muqaddes Mehraj: muqaddesmehraj91@gmail.com

Wah medical college, Wah Cantt, PAK.

Sarah Arshad: Arshsarah23@gmail.com

Central Park medical college, Lahore, PAK.

Umer Farooq: umer0919@gmail.com

Graduate of Rawalpindi Medical University, Rawalpindi, PAK.

Syed Turab Haider: turabhaider333@gmail.com

Nishtar Medical University Multan

***Javed Iqbal:** jiqbal3@hamad.qa

Nursing Department Communicable Diseases Center, Hamad medical Corporation, Doha, Qatar.

Abdur Rehman: dr.malik.ar123@gmail.com

Graduate of Rawalpindi Medical University, Rawalpindi, PAK.

Shahzaib Maqbool: Hasanshahzaib299@gmail.com

Graduate of Rawalpindi Medical University, Rawalpindi, PAK

Rabia Zaheer: Rabiazaheer1998@gmail.com

Liaquat University of medical and health sciences, Jamshoro. PAK.

Corresponding author:

Name: Javed Iqbal

Address: Nursing Department Communicable Diseases Center, Hamad medical Corporation, Doha, Qatar, 3050.

Email: jiqbal3@hamad.qa

ORCID ID: 0000-0003-2627-685X

Telephone No.: +97455951635

Key Clinical Message:

Adjusting the pressure of a programmable ventriculoperitoneal (VP) shunt can effectively resolve chronic subdural hematoma (CSDH) in patients with normal pressure hydrocephalus (NPH), potentially eliminating the need for surgical intervention. This case highlights a novel, non-invasive approach to managing CSDH, underscoring the importance of individualized shunt management.

Abstract :

Introduction:

Chronic subdural hematoma formation is a common risk factor for patients who have undergone shunting procedures to relieve symptoms related to normal pressure hydrocephalus because of underlying over-drainage and provide the potential space for hematoma expansion. The report emphasizes the importance of using pressure adjustments in programmable VP shunts to treat this condition.

Case History/Examination:

Herein, we present a rare case of spontaneous resolution of chronic subdural hematoma after resetting the pressure of a programmable ventricular peritoneal shunt in a 72-year-old male who developed normal pressure hydrocephalus, for which he was treated with a VP shunt. A year after shunting, the patient came back with signs and symptoms of chronic subdural hematoma, and VP shunt pressure adjustment raised them from 100 to 150 mm of H₂O as a result of this intervention. The hematoma was successfully resolved, and the patient exhibited significant improvement.

Conclusion:

CSDH is a known complication after NPH treatment with a programmable VP shunt. However, adjusting the pressure in the right way cannot only prevent this complication but also resolve CSDH if it develops.

Discussion:

Surgical evacuation has been the mainstay of treatment for CSDH, especially if the hematoma is large and the patient shows significant neurological symptoms, a mass effect, or a significant midline shift. However, there have been some reports of spontaneous resolution of CSDH over the years, and some interesting theories behind their resolution have been proposed. None of these reports include a patient who develops

a CSDH specifically as a complication following VPS placement. This case presents a unique scenario where a programmable ventriculoperitoneal shunt (VPS) used to treat hydrocephalus led to the development of a CSDH, which resolved spontaneously after adjusting the shunt pressure. We discovered a possible intervention that could save the patient from further morbidity by excluding the need for further surgery.

Keywords: Normal-pressure hydrocephalus, Chronic Subdural Hematoma, Ventriculoperitoneal shunt, programmable VP shunt.

Introduction :

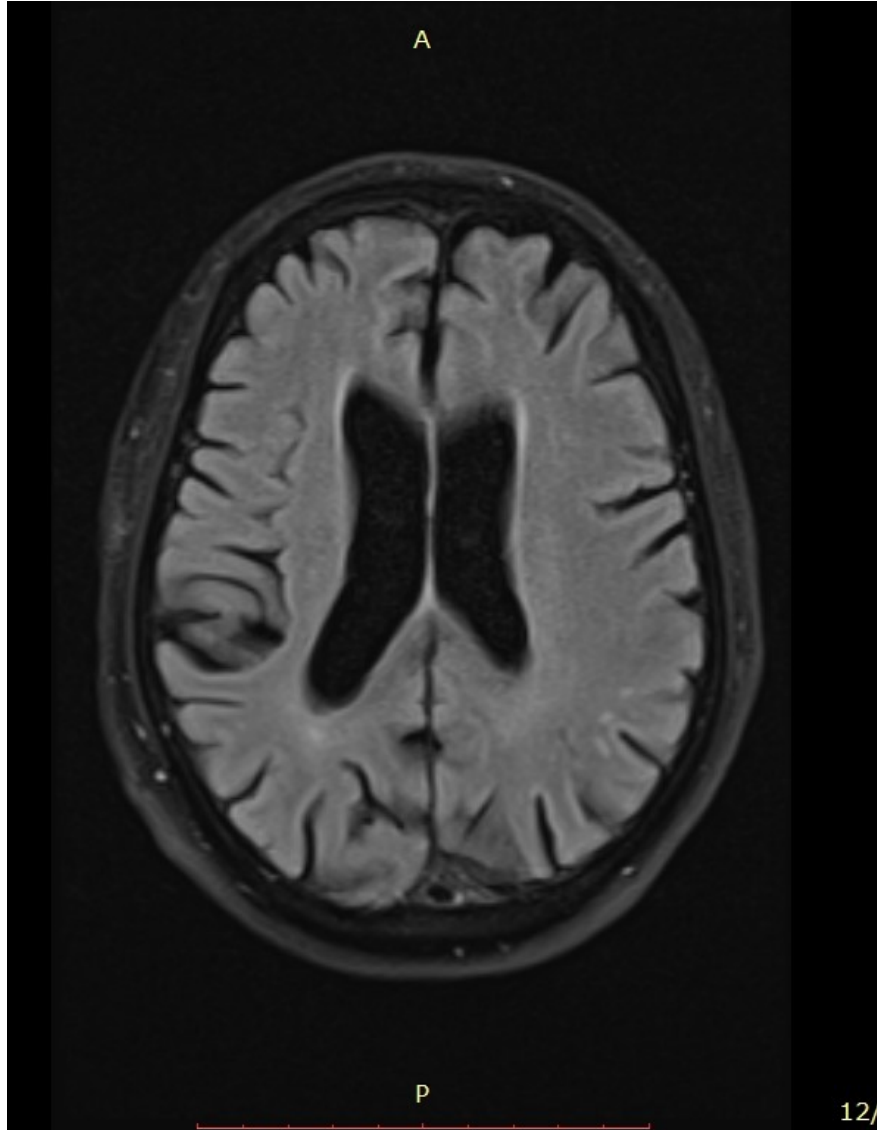
Normal-pressure hydrocephalus (NPH) is characterized by the triad, including confusion, magnetic gait, and urinary incontinence caused by a gradual blockage of cerebrospinal fluid (CSF) drainage. NPH is usually idiopathic, but its etiology remains largely unknown. Management of patients with NPH involves the placement of a ventriculoperitoneal shunt to aid CSF drainage [1]. The placement of adjustable shunt valves enables easy, non-invasive adjustments in the amount of CSF drainage to maximize symptom relief and minimize over-drainage, thus reducing the need for repeated surgical interventions to manage shunt pressure with fixed pressure valves. Chronic Subdural Hematoma (CSDH) is a known complication in patients undergoing VP shunt placement for NPH [2]. The risk of CSDH underscores the importance of carefully managing CSF drainage in NPH patients. The advent of adjustable VP shunt valves has transformed the management of NPH [3]. These devices offer the advantage of non-invasive adjustments in CSF drainage rates, enabling healthcare providers to fine-tune the shunt's performance according to the patient's evolving condition. Herein, we are reporting a rare case of CSDH, which was resolved following the placement of a programmable VP shunt. The work has been reported per the SCARE criteria [4].

Case History/Examination:

A 72-year-old male with no known comorbidities sought medical attention in the outpatient department, reporting a three-month history of deteriorating symptoms, including poor balance, repeated falls, cognitive decline, mood alterations, and urinary incontinence. On examination, the patient's feet felt stuck to the floor, i.e., a freezing gait. Examination of other systems, including the nervous system, uncovered no abnormalities.

Methods:

Baseline investigations were performed on admission to the department, and they were within reference ranges. An urgent MRI of the brain was ordered, which revealed notably enlarged disproportionate ventricles and an Evans index of 0.3, as shown in **Figure 1**.



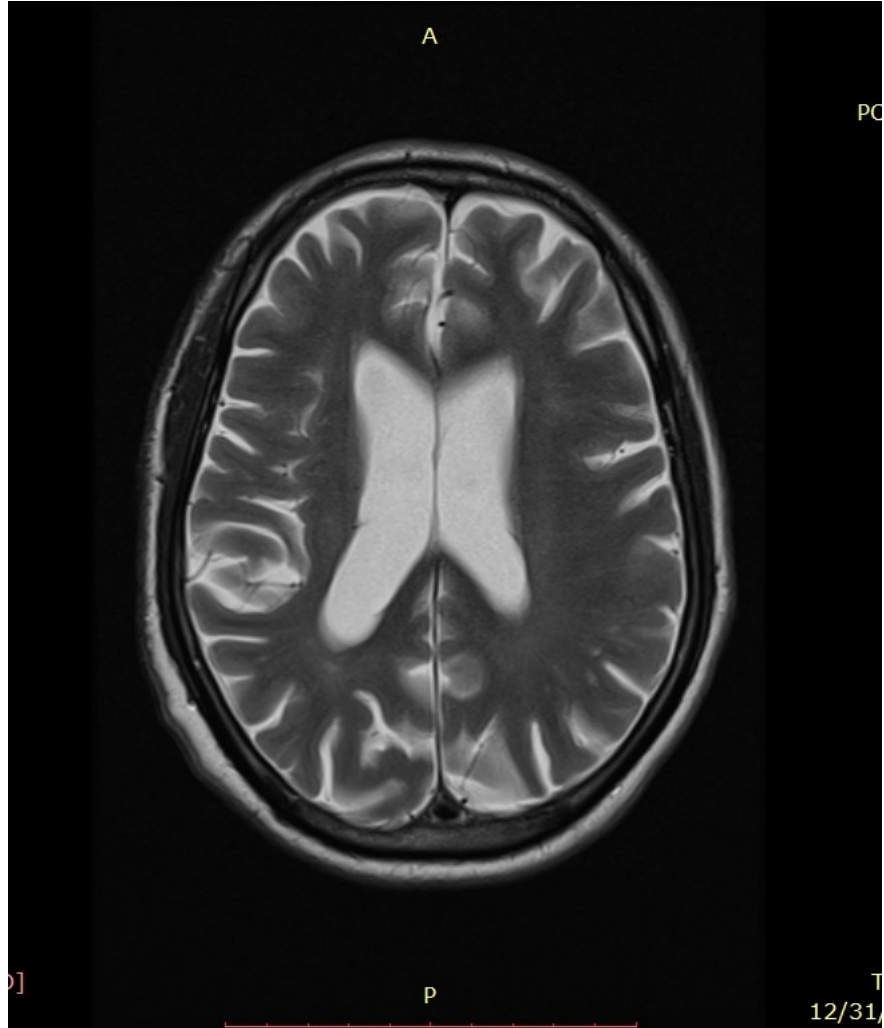


Fig. 1: Showing the disproportionately enlarged ventricles and Evans index of 0.3 validating the diagnosis of normal pressure hydrocephalus.

To confirm the diagnosis, therapeutic and diagnostic tests were done, i.e., a Miller-Fisher test /Tap test in which 30 ml of CSF fluid was removed and patient gait was assessed, which showed significant improvement. Based on clinical symptoms, physical examination findings, imaging results, and improvement of symptoms after the tap test, it was hence confirmed the diagnosis of Normal Pressure Hydrocephalus (NPH), for which the patient underwent treatment via the placement of a programmable ventriculoperitoneal (VP) shunt. Subsequently, he displayed significant postoperative improvement. However, a year later, the patient returned with new complaints, including blurred vision, headaches, impaired balance, and recurrent urinary incontinence. MRI of the brain demonstrated bilateral chronic subdural hematoma, as shown in **Figure 2**.

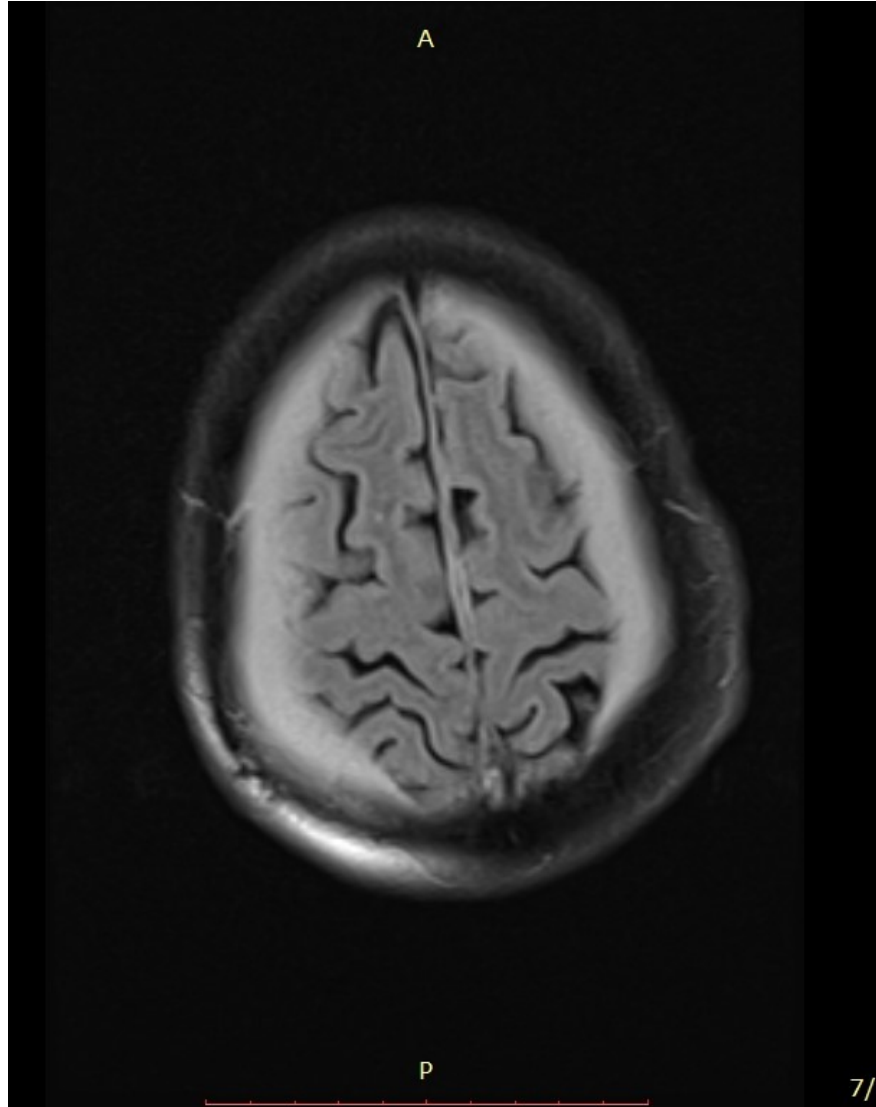


Fig. 2: Showing the presence of chronic subdural hematoma on MRI brain (T2 weighted).

The shunt pressure settings were adjusted from 100 to 150 mm H₂O. This modification aimed to reduce the flow and create a mild elevation in intracranial pressure, effectively acting as a tamponade to restrict the hematoma's expansion.

Conclusion and Results:

As a result of this intervention, the hematoma was successfully resolved, and the patient exhibited significant improvement. Notably, the procedure proceeded without encountering any complications. Postoperatively, the patient was seen in OPD one month later with a completely normal gait and significantly improved since his last visit, validating the usefulness of a programmable VP shunt in improving CSDH. The MRI brain following the resolution of CSDH is given in

Figure 3.

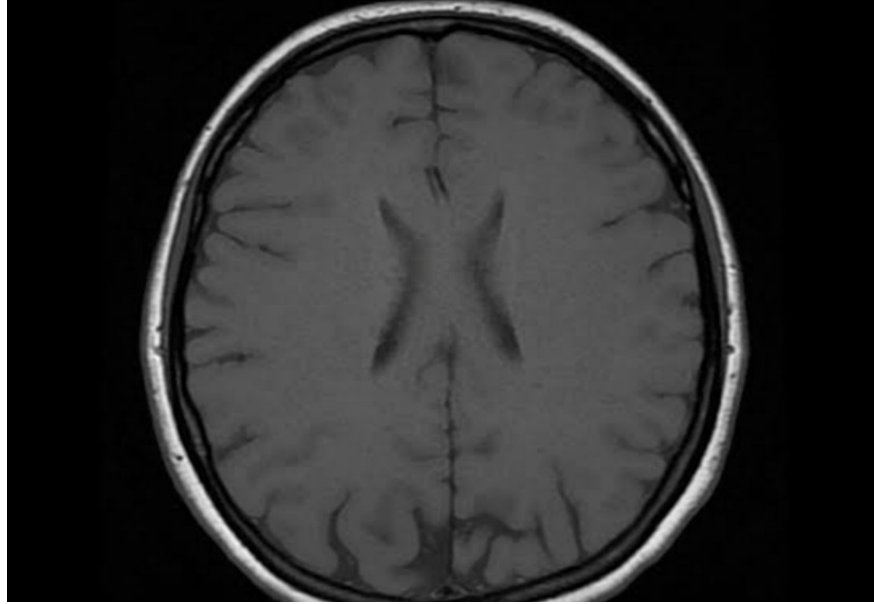


Fig. 3: Showing the resolution of CSDH after adjustment of programmable VP shunt pressure.

In conclusion, this case highlights the innovative use of a programmable VPS to manage and resolve CSDH, providing a promising alternative to traditional surgical methods. As more cases are documented and studied, we may uncover more precise guidelines for utilizing this technology to its full potential in treating CSDH and other related complications.

Discussion :

The cells at the border between the arachnoid and dura mater are the source of CSDH. Cerebral atrophy stretches the abundant bridge veins in this area. A true subdural space is created when traumatized microruptures of the bridge veins cause blood to extravasate; in the absence of trauma, the subdural space is only theoretical because of the loose cellular layer in the subdural space. This layer, however, lacks the collagen that fills the third space with tight cellular connections. Since there is a smaller amount of collagen in that area, there is lower resistance to developing hematomas, encouraging their expansion. Creating the visceral and parietal neo-membranes involving the CSDH expands in response to the imbalance between injury and tissue repair processes. Vascular neoformation and enzymatic hyperfibrinolysis follow, leading to the hematoma expanding over time [5].

Surgical evacuation has been the mainstay of treatment for CSDH, especially if the hematoma is large and the patient shows significant neurological symptoms, a mass effect, or a significant midline shift. However, there have been some reports of spontaneous resolution of CSDH over the years, and some interesting theories behind their resolution have been proposed [6–8]. Small volumes, negligible mass effect, settlement in the frontal region, low density in the tomography, and insufficient midline deviation are indications that the CSDH will resolve without intervention. Clinically, people with little to no neurological symptoms or who are asymptomatic typically have spontaneous remission [9, 10]. Encouraged by these instances, clinicians have tried to discover non-surgical interventions that may improve the resolution of CSDH. These include, but are not limited to, clinical monitoring, reinforced restriction of physical activity, anticoagulant suspension, and coagulation problem repair. In addition, there have been reports of the usage of drugs such as mannitol, ACE inhibitors, atorvastatin, corticosteroids, and tranexamic acid. However, the data for the use of these drugs is limited and warrants further research [10–14].

None of these reports include a patient who develops a CSDH specifically as a complication following VPS placement. This case presents a unique scenario where a programmable ventriculoperitoneal shunt (VPS)

used to treat hydrocephalus led to the development of a CSDH, which resolved spontaneously after adjusting the shunt pressure. We discovered a possible intervention that could save the patient from further morbidity by excluding the need for further surgery. It is a poetic solution in that the cause of the problem can be used to eliminate the problem itself. By carefully adjusting the pressure settings on the programmable VPS, the intracranial pressure can be modulated to facilitate the resolution of the CSDH. As the use of programmable VPS increases, we can further test this theory to ascertain its utility. This approach also reduces the need for trials of different drugs that may cause unnecessary side effects.

It is a novel solution for a chronic complication; finding an effective countermeasure for this complication will help increase confidence in physicians using VPS for treatment where required. Moreover, it opens avenues for a more personalized approach to managing CSDH, especially in patients with concurrent hydrocephalus. Given that programmable VPSs allow for non-invasive adjustments, it offers a dynamic tool for clinicians to manage intracranial pressure changes over time. Additionally, this method can lead to significant cost savings by reducing the need for repeat surgical interventions and prolonged hospital stays. Promoting the spontaneous resolution of CSDH through non-surgical means can improve patient outcomes and quality of life. Future studies should focus on the optimal pressure settings and timing for adjustments in programmable VPS to maximize their therapeutic benefits in managing CSDH.

Consent

Written informed consent was obtained from the patient for publication and any accompanying images.

Ethical approval

Ethical approval for this study was provided by the Ethical Committee of Wah Medical college, Wah Cantt, PAK.

Funding

Funding for Open Access provided by Qatar National Library

Author contribution statement

All authors contributed in the study design, writing of the paper, and final approval of the case report.

Guarantor

Muqaddes Mehraj

Conflict of interest statement

None.

Authorship contribution statement:

1. **Ali Haider:** Conceptualization, Methodology, and Supervision
2. **Muhammad Mehboob Alam:** Conceptualization, Data curation, and Investigation
3. **Muqaddes Mehraj:** Data curation, Methodology, and Writing - original draft
4. **Sarah Arshad:** Data curation, Formal analysis, and Visualization
5. **Umer Farooq:** Data curation, Investigation, Methodology, and Writing - original draft
6. **Syed Turab Haider:** Methodology, Software, and Writing - original draft
7. **Javed Iqbal:** Funding acquisition, Resources, Supervision, Validation, and Visualization
8. **Abdur Rehman:** Software, Writing - original draft, and Writing - review & editing
9. **Shahzaib Maqbool:** Software, Visualization, Writing - original draft, and Writing - review & editing
10. **Rabia Zaheer:** Methodology, Writing - original draft, and Writing - review & editing

References:

1. Gelabert-González M, Iglesias-Pais M, García-Allut A, Martínez-Rumbo R. Chronic subdural haematoma: surgical treatment and outcome in 1000 cases. *Clin Neurol Neurosurg.* 2005;107(3):223-9.

2. Ducruet AF, Grobelny BT, Zacharia BE, et al. The surgical management of chronic subdural hematoma. *Neurosurg Rev.* 2012;35(2):155-69; discussion 169.
3. Weigel R, Schmiedek P, Krauss JK. Outcome of contemporary surgery for chronic subdural haematoma: evidence based review. *J Neurol Neurosurg Psychiatry.* 2003;74(7):937-43.
4. Sohrabi C, Mathew G, Maria N, Kerwan A, Franchi T, Agha RA. The SCARE 2023 guideline: updating consensus Surgical Case Report (SCARE) guidelines. *International Journal of Surgery.* 2023 May 1;109(5):1136-40.
5. Sousa EB. Perfil Epidemiológico Dos Pacientes Submetidos À Drenagem De Hematoma Subdural Crônico No Distrito Federal: Análise De Uma Série Monocêntrica De 778 Pacientes. 2013. 92 F., IL. Dissertação (Mestrado em Ciências Médicas) Universidade De Brasília, Brasília. 2013.
6. Lee GS, Park YS, Min KS, Lee MS. Spontaneous resolution of a large chronic subdural hematoma which required surgical decompression. *J Korean Neurosurg Soc.* 2015;58:301-3.
7. Yilmaz H, Boyali O, Atci IB, Kocaman U. Spontaneous resolution of post-traumatic chronic subdural hematoma: a case report. *Pan Afr Med J.* 2017;28:167. Published 2017 Oct 20. doi:10.11604/pamj.2017.28.167.13944
8. Junior MGP, Pessoa BL, Landeiro JA, de Abreu Macedo PH, Leite MAA. Spontaneous resolution of chronic subdural hematoma: Does only the size matter?. *Surg Neurol Int.* 2019;10:194. Published 2019 Oct 4. doi:10.25259/SNI.58.2019
9. Gusmão SN. Complicações tardias do traumatismo cranioencefálico. In: Braga FM, de Melo PM, editors. *Manole: Guia de Medicina Ambulatorial e Hospitalar Escola Paulista de Medicina: Neurocirurgia.* 2005. pp. 21-30.
10. Yilmaz H, Boyali O, Atci IB, Kocaman U. Spontaneous resolution of post-traumatic chronic subdural hematoma: A case report. *Pan Afr Med J.* 2017;28:167.
11. Bansal H, Mahajan A, Singh A, Chaudhary A. Spontaneous disappearance of a large chronic subdural hematoma: A Pleasant surprise. *Indian J Surg.* 2015;77:532-4.
12. Wang D, Li T, Tian Y, Wang S, Jin C, Wei H, et al. Effects of atorvastatin on chronic subdural hematoma: A preliminary report from three medical centers. *J Neurol Sci.* 2014;336:237-42.
13. Zou L, Li G, Zhao J, Zhang Y, Hou K. Management of spontaneous cerebrospinal fluid hypovolemia-associated massive chronic subdural hematoma with reinforced restriction of physical activity: report of three cases. *J Int Med Res.* 2020;48(11):300060520969321. doi:10.1177/0300060520969321
14. Yasuda CL, Morita ME, Nishimori FY, Yasuda AM, Alves HL. Hematoma subdural crônico: Estudo de 161 pacientes operados e a relação com alterações no coagulograma. *Arq Neuropsiquiatr.* 2003;61:1011-4.