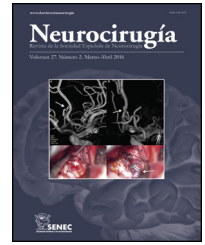




## NEUROCIRUGÍA

[www.elsevier.es/neurocirugia](http://www.elsevier.es/neurocirugia)


## Review article

# Spontaneous resolution of traumatic acute subdural haematomas: A systematic review



Roberto Bezerra Vital\*, Pedro Tadao Hamamoto Filho, Victor Azevedo de Oliveira, Flávio Ramalho Romero, Marco Antônio Zanini

Botucatu Medical School; UNESP Univ Estadual Paulista; Department of Neurology, Psychology and Psychiatry, Botucatu, SP, Brazil

## ARTICLE INFO

## Article history:

Received 19 March 2015

Accepted 10 May 2015

Available online 2 July 2015

## Keywords:

Traumatic brain injury

Subdural haematoma

Brain haemorrhage

## ABSTRACT

**Introduction:** Traumatic subdural haematomas often require emergency surgical evacuation. Spontaneous resolution of traumatic acute subdural haematomas (TASDH) is under-reported. Two patients are described with spontaneous resolution of TASDH correlating with previous reports. A discussion is presented on the clinical, pathological and radiological features of TASDH.

**Methods:** A review of the literature was performed using PubMed (Medline), Embase, and Cochrane Library for similar cases.

**Results:** A total 21 articles were included, involving 27 cases well detailed of TASDH with spontaneous resolution or neurological and radiological improvement in less than 24 h.

**Conclusions:** There are two main mechanisms for the spontaneous resolution of acute subdural haematomas: dilution in subarachnoid space and redistribution of the haematoma in the subdural space. The primary radiological characteristic of these lesions is a hypodense rim on the outer surface of the clot. Spontaneous resolution of TASDH is unusual. Clinical and radiological surveillance is essential for appropriate management of these patients.

© 2015 Sociedad Española de Neurocirugía. Published by Elsevier España, S.L.U. All rights reserved.

## Resolución espontánea de hematoma subdural agudo traumático: una revisión sistemática

## RESUMEN

**Introducción:** Los hematomas subdurales agudos traumáticos (HSDAT) requieren tratamiento quirúrgico de urgencia. Muy raras veces se describen casos de resolución espontánea de HSDAT. Describimos 2 casos de resolución espontánea de HSDAT y revisamos la bibliografía pertinente. Se discuten los aspectos clínicos, patológicos y radiológicos de resolución espontánea de HSDAT.

## Palabras clave:

Traumatismo craneal

Hematoma subdural

Hemorragia cerebral

\* Corresponding author.

E-mail address: [roberto.vital@hotmail.com](mailto:roberto.vital@hotmail.com) (R.B. Vital).

<http://dx.doi.org/10.1016/j.neucir.2015.05.003>

1130-1473/© 2015 Sociedad Española de Neurocirugía. Published by Elsevier España, S.L.U. All rights reserved.

**Métodos:** Revisamos la literatura en Pubmed (Medline), Embase y Cochrane Library en busca de casos similares.

**Resultados:** Se incluyeron 21 artículos con 27 casos bien detallados de HSDAT con resolución espontánea o mejora clínica y radiológica en 24 h.

**Conclusiones:** Existen 2 mecanismos principales para la resolución espontánea de hematomas subdurales agudos: la dilución en el espacio subaracnoideo y la redistribución del hematoma en el espacio subdural. La principal característica radiológica de estas lesiones es una cerco hipodenso en la superficie exterior del coágulo. La resolución espontánea de HSDAT es rara. La vigilancia clínica y radiológica es esencial para el manejo adecuado de estos pacientes.

© 2015 Sociedad Española de Neurocirugía. Publicado por Elsevier España, S.L.U. Todos los derechos reservados.

## Introduction

Traumatic acute subdural hematomas (TASDH) present high morbidity and mortality rates and require surgical intervention in almost all cases.<sup>1,2</sup> Mechanism of trauma and associated brain parenchymal injuries contribute to the severity of this complex condition.<sup>3-5</sup>

Conservative treatment may be an option in patients whose neurological status is good,<sup>4</sup> but rigorous clinical and radiological observation are recommended,<sup>5</sup> and for patients with irreversible neurological damage who are in poor clinical condition.<sup>6</sup> Because the majority of TASDH are promptly surgically drained, the spontaneous mechanisms for its resolution are possibly underestimated and its natural course is uncertain.

We herein present 2 illustrative cases of TASDH with radiological or clinical improvement in less than 24 h. All patients had a good clinical outcome. Additionally, we review the literature and discuss the possible mechanisms for spontaneous resolution of TASDH.

## Methods

We performed a literature review in published case reports in English Language, describing TASDH with improvement or total resolution within 24 h. The search strategy was made using Pubmed, MEDLINE and Cochrane Library databases from January 1980 to December 2013. Keywords from the MESH database were Acute Subdural Hematoma, Resolution, Redistribution and Improvement. Full publications were obtained based on the titles or abstracts selected by at least 2 of the reviewers. All retrieved titles and abstracts were reviewed independently by 2 of the investigators (R.B.V. and P.T.H.F.). Full publications were reviewed to select the studies to be included in the review. Manual searching of reference lists of all retrieved articles completed the article searches.

The inclusion criteria for reports were: (1) patients presenting with TASDH, (2) neurological and or radiological improvement or total resolution of the hematoma within 24 h, (3) cases with documented radiological assessment, (4) conservative treatment and (5) papers published in English. All cases

with non-traumatic hematomas, like coagulopathy and others etiologies, with incomplete patient data and spinal primary hematomas were excluded.

## Results

Electronic search found 76 articles. Thirty-four were not selected for non-traumatic etiology of the hematoma, or non-cranial topography or different subject. Among the 42 selected articles, twelve were excluded for missing data, three for neurological improvement or resolution of the hematoma after 24 h, five for non-English article after full review and one for non-traumatic etiology. Thus we included 21 articles involving 27 cases of acute subdural hematomas with spontaneous resolution or neurological and radiological improvement (Fig. 1).

Through the included 27 cases we found 16 (59%) to be male, 14 (52%) of the hematomas on the right side and 12 (44%) due to traffic accidents. The mean age was 36 years, GCS was 9.3 (median 8) and time for neurological or radiological improvement was 6.5 h. Complete data are presented on Table 1.

## Illustrative cases

### Case 1

This patient was a 21-year-old female who was a victim of a traffic accident, specifically, a motorcycle collision. The patient had a Glasgow Coma Scale (GCS) score of 12, and an initial Computed Tomography (CT) scan disclosed a left fronto-parietal TASDH that was approximately 12 mm at the largest width and a small ipsilateral temporal contusion. She was then referred to our hospital. At the time of arrival (2 h after the trauma) she had GCS score of 14 with isochoric photoreactive pupils. A new CT was performed approximately 6 h after the first, and revealed no subdural collection. The following day, the patient had no symptoms or neurological abnormalities and no TASDH was observed on a CT scan. At a six-month follow-up she remained without complaint and GOS (Glasgow Outcome Scale) 5 (Fig. 2).

**Table 1 – TASDH with spontaneous improvement in less than 24 h.**

Author, year	Sex, age (yrs <sup>a</sup> )	Trauma mechanism	Initial clinical presentation	CT location and size	Time for improvement (h)
Niikawa, 1989 (Case 3) <sup>16</sup>	F, 24	Traffic Accident	GCS 10, lethargic	Left FP	6
Niikawa, 1989 (Case 4) <sup>16</sup>	M, 48	Traffic Accident	GCS 9, right dilated pupil	Right FP	6
Joki, 1992 (Case 1) <sup>26</sup>	F, 21	Fall Injury	GCS 9	Left FP	8
Joki, 1992 (Case 2) <sup>26</sup>	M, 23	Fall Injury	GCS 14, right hemiparesis	Left FP	24
Matsuyama, 1997 <sup>13</sup>	M, 18	Sports Head Injury	GCS 15, severe headache and nausea	Left FTP, 15 mm	3
Cohen, 1998 <sup>18</sup>	M, 27	Traffic Accident	GCS 7, left dilated pupil	Left FTP	12
Tsui, 2000 <sup>17</sup>	M, 54	Fall Injury	GCS 15, seizures	Right FP, >10 mm	6
Berker, 2003 <sup>3</sup>	M, 57	Blunt head injury	GCS 7, dilated left pupil	Left TP	2.5
Bortolotti, 2004 <sup>19</sup>	F, 23	Sports Head Injury	GCS 15, headache	Left FT, >10 mm	12
Sato, 2005 (Case 2) <sup>27</sup>	M, 88	Traffic Accident	GCS 10	Right FTP	3
Sato, 2005 (Case 1) <sup>27</sup>	F, 92	Fall Injury	GCS 7, right pupil dilated and fixed	Right FTP	8
Mirzai, 2005 <sup>28</sup>	M, 19	Blunt head injury	GCS 9	Right FTP	3
Kapsalaki, 2007 (Case 1) <sup>15</sup>	M, 29	Traffic Accident	GCS 8	Left FT, 18 mm	13
Kapsalaki, 2007 (Case 2) <sup>15</sup>	F, 24	Traffic Accident	GCS 7	Right FP	4
Kapsalaki, 2007 (Case 3) <sup>15</sup>	F, 29	Traffic Accident	GCS 8	Right FT, 9 mm	6.5
Kapsalaki, 2007 (Case 4) <sup>15</sup>	M, 36	Traffic Accident	GCS 8	Left FT, 8 mm	6.5
Cosar, 2007 <sup>11</sup>	M, 8 months	Fall Injury	GCS 15, seizures	Right FP, <10 mm	9
Wong, 2009 <sup>20</sup>	F, 73	Fall Injury	GCS 8	Left FTP, 22.4 mm	5.5
Wen, 2009 <sup>1</sup>	M, 22	Trunk trauma (no direct hit)	GCS 11, LOC <sup>b</sup> , lethargic, vomiting	Left FTP,	4
Lee, 2009 <sup>6</sup>	M, 61	Traffic Accident	GCS 4, bilateral non-reactive mydriasis	Right FTP, 25.9 mm	14
Yadav, 2011 <sup>22</sup>	M, 55	Traffic Accident	GCS 6	Right FTP	6
Hadjigeorgiou, 2012 <sup>29</sup>	M, 64	Fall Injury	GCS 15, headache, nausea	Right, PO, 10 mm	8
Balik, 2013 <sup>14</sup>	M, 66	Fall Injury	GCS 6, LOC <sup>b</sup>	Left FP	16
Park, 2013 <sup>30</sup>	F, 7	Traffic Accident	GCS 5, left hemiparesis, right dilated pupil	Right FTP	2
Liu, 2013 <sup>31</sup>	F, 48	Fall Injury	GCS 7, vomiting	Right FTP	22
Shin, 2013 <sup>32</sup>	F, 48	Traffic Accident	GCS 6, lethargic	Right FTP, 10 mm	1
Towers, 2014 <sup>33</sup>	F, 84	Fall Injury	GCS 11	Left FTP, 16 mm	12

FP, frontoparietal region; FTP, frontotemporoparietal region; FT, frontotemporal region; PO, parietooccipital.

<sup>a</sup> Years.

<sup>b</sup> LOC: loss of consciousness.

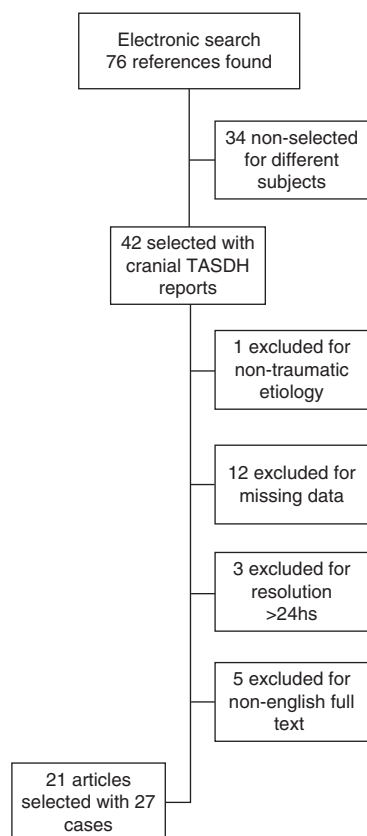
## Case 2

This patient was a 28-year-old female who suffered a head-to-head collision during sports practice. Immediately after the collision, she had no symptoms. Within a few hours, she developed a headache, vomiting, drowsiness, and seizures. At hospital admission, her symptoms were headache and vomiting, she remained conscious (GCS score of 15), and her pupils were isochoric and photoreactive. The initial CT scan showed a left fronto-temporo-parietal TASDH with a midline shift of 5 mm. Treatment for the patient consisted of strict surveillance in the neurological intensive care unit. A new CT scan after 20h showed a marked decrease in hematoma volume and midline shift. The patient was discharged after two days

without symptoms or neurological abnormalities and GOS 5 (Fig. 3).

## Discussion

TASDH are managed surgically in approximately 90-97% of cases.<sup>5,7</sup> The surgical treatment aim to treat the primary lesions and prevent secondary injuries, responsible for the poor prognosis of this entity. Since the majority of published series reports those scenarios, the real prevalence of conservative cases is underestimated. For instance, a recent case series revealed an incidence around 32% of TASDH with spontaneous resolution.<sup>8</sup> The lack of novelty regarding the subject is probably the reason for this gap of literature.



**Fig. 1 – Flow chart of literature review.**

From our series review, 14 of the 27 patients had GCS of 9 or lower, six of those with dilated pupils, with clearly indications for surgical evacuation.<sup>7</sup> The conservative management was opted mostly by the families, specially when came from Asian countries.

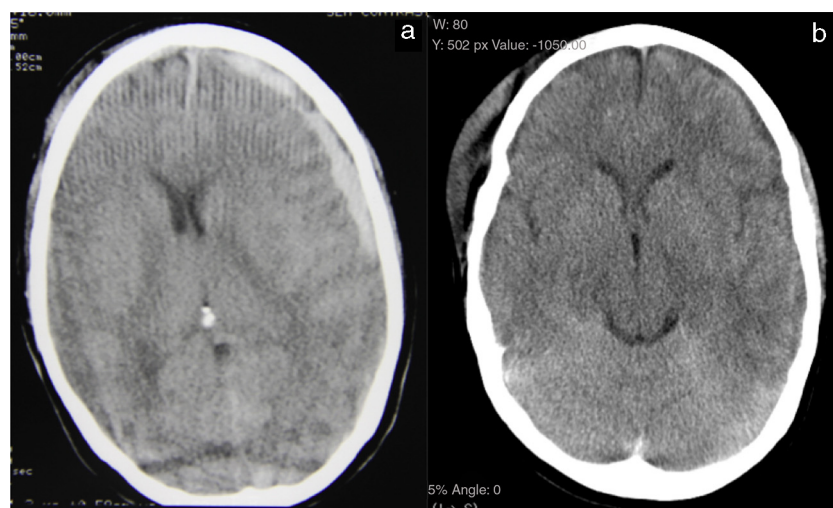
Conservative treatment may be plausible in select patients.<sup>9</sup> Good candidates are patients whose neurological status is favorable (GCS  $\geq 13$ ), who have a hematoma thickness of less than 10 mm, whose hematoma displays a deviation from the midline structures that is less than 10 mm, who have no other severe associated injuries and who have basal cisterns.<sup>4,5</sup> From those aspects, the most relevant for decision of surgical cases are the midline shift and clot volume.<sup>10</sup>

Spontaneous resolution of TASHD is a known but barely described entity, especially within 24 h. However, it can occur, even with large collections.<sup>6</sup> Spontaneous resolution of TASHD may be observed in patients with a good neurological status (mild to moderate TBI, a transient coma lasting less than 12 h, or an absence of brain contusions),<sup>11</sup> with collections in which longitudinal extension is greater than the width of the hematoma,<sup>1</sup> collections smaller than 30 cc, collections located near the Sylvian fissure, in young patients,<sup>12</sup> in the presence of a previous subdural hygroma<sup>11</sup> and in cases with cortical atrophy.<sup>4</sup> These are all good prognostic factors.

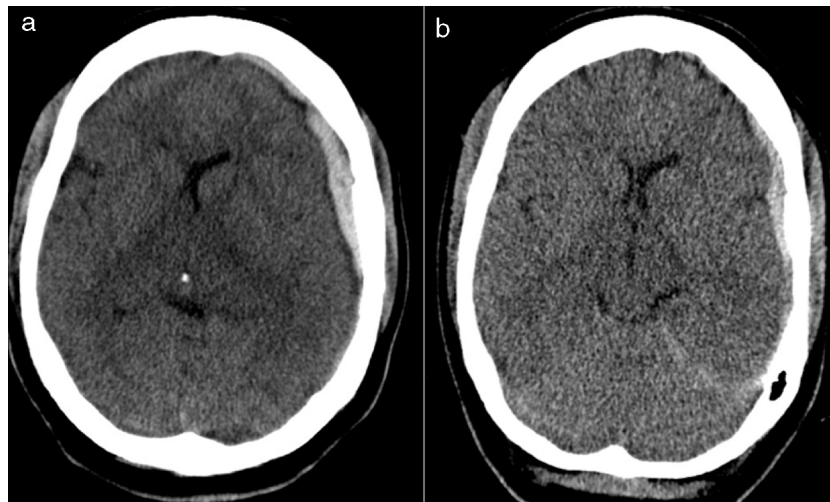
We compiled similar cases from the literature. In our report, both patients were young and had good neurological scores because all of the patients were very young, no previous collections would be present. The mechanical causes were a sports injury in one case and a traffic accident in the others. Both patients had conservative treatment for their hematomas, and either spontaneous resolution or a marked decrease in volume was observed within 24 h. Currently none of the patients has any neurological deficits.

Two main mechanisms for spontaneous resolution of TASHD have been proposed: cerebrospinal fluid (CSF) dilution and spatial redistribution of the hematoma. Although the terms found in the literature like resolution, redistribution, dissolution and improvement can occasionally be confuse, we believe the resolution of the hematomas itself is a mixture of the those proposed mechanisms.

Dilution of the subdural hematoma within the CSF occurs when there is an adjacent arachnoid injury; thus, the clot is dissolved by the CSF.<sup>13</sup> This phenomenon is observed when



**Fig. 2 – (a) The initial CT scan immediately after the trauma shows a left fronto-parietal TASHD with a hypodense signal between the clot and the inner table of the skull. (b) A CT scan performed after 6 h shows the absence of the TASHD and a thin layer of CSF where the clot was seen previously.**



**Fig. 3 – (a) The initial CT scan shows a left fronto-temporo-parietal TASDH with a midline shift of 5 mm. The inner hypodense signal suggests the presence of CSF below the clot. (b) The new CT after 20 h demonstrates a great reduction in the TASDH and the midline shift.**

there is an increased amount of blood in both cisternal and subarachnoid space after clot dissolution<sup>10,14</sup> or an increase in the volume of a previous subdural effusion.<sup>11</sup>

Spatial redistribution of the hematoma has been previously described to occur through the following processes: swelling (an increase in ICP) may force the expulsion of the hematoma from its initial site,<sup>15,16</sup> redistribution may be associated with cortical atrophy<sup>17,18</sup> or redistribution may occur through an adjacent linear fracture.<sup>3,15</sup> The subdural hematoma may still migrate through the posterior fossa<sup>14,19,20</sup> or clivus<sup>21</sup> into the spinal subdural space.

We believe that for most cases, a combination of both of the previously described mechanisms occurs, as is suspected in our cases, a mixture of redistribution and dissolution. More recently, a piston-like mechanism was proposed, based on variation in ICP that is secondary to the primary and secondary injuries,<sup>22</sup> although this hypothesis is another variation of the redistribution mechanism.

A radiological characteristic that suggests the possibility of spontaneous resolution is the presence of a hypo-to-isodense signal on the external surface of the clot.<sup>1,6,8,11,15,17,23</sup> In our cases, a hypodense rim was observed around the hematoma, and in case 2, this rim was observed on the inner surface, which differs from previous reports. This hypodense radiological signal corroborates the CSF dissolution hypothesis.

Our aim was to review the literature for similar cases and find if new concepts about the pathophysiology of the spontaneous resolution are available and which subgroup of TASDH should have conservative treatment as an option. The limitation of our review is the searching process selected most case reports and series, and three retrospective cohorts were excluded<sup>9,24,25</sup> due to lack of individual information. It should be reminded that the time for radiological improvement under 24 h is usually recorded when the CT scan is repeated, thus may not represent the real time for clinical amelioration.

Despite conservative treatment is reserved for patients with GCS higher or equal than 13, we observe that mean

GCS of the patient's presentation was 9.27, from this review. One may argue that spontaneous resolution of TASDH is just an anecdotal observation through several series. It may be inferred conservative treatment as a plausible choice for patients with those typical radiological features, even in comatose patients, provided by serial clinical and radiological reevaluation. Recent evidences suggests that about 65% of the conservative TASDH have spontaneous resolution within 8 weeks.<sup>10</sup>

Prospectively cohorts with strict follow up of patients should be the purpose of future investigations on this subject, evaluating them according to patients demographics, the size of TASDH, their evolution, radiological features, clinical or surgical management, ICP measurement if any and final outcome. Furthermore the radiological characteristics foretell likelihood of resolution would need to be evaluated in a larger series including TASDHs that do not resolve, in order to state a predictive value.

## Conclusions

Spontaneous resolution is possible in patients with TASDH. CSF dissolution and spatial redistribution contribute to the resolution of these hematomas. A hypodense signal within the hematoma may be of predictive value in the decision support for non-surgical treatment, even in comatose patients, provided there will be continuous clinical assessment and prompt radiological reevaluation as necessary. Prospective cohort series should be done to define specific subgroups of patients for whom conservative treatment is acceptable.

## Competing interests

The authors declare that there are not any financial or non-financial competing interests regarding this research.



## Funding

This research was funded by the authors itself.

## Written informed consent

Consent was obtained from the patient for publication of this Case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

## Author contributions

RBV: draft and designed the manuscript; PTHF: draft and coordinated the manuscript; VAO: reviewed the literature for the similar cases; FRR: grammatical and design review. MAZ: final review. All authors read and approved the final manuscript.

## Acknowledgements

None.

## REFERENCES

- Wen L, Liu WG, Ma L, Zhan RY, Li G, Yang XF. Spontaneous rapid resolution of acute subdural hematoma after head trauma: is it truly rare? Case report and relevant review of the literature. *Ir J Med Sci.* 2009;178:367-71.
- Bullock MR, Chesnut R, Ghajar J, Gordon D, Hartl R, Newell DW, et al. Surgical management of acute epidural hematomas. *Neurosurgery.* 2006;58 3 Suppl. S7-S15.
- Berker M, Gulsen S, Ozcan OE. Ultra rapid spontaneous resolution of acute posttraumatic subdural hematomas in patient with temporal linear fracture. *Acta Neurochir (Wien).* 2003;145:715-7 [discussion 17].
- Mathew P, Oluoch-Olunya DL, Condon BR, Bullock R. Acute subdural haematoma in the conscious patient: outcome with initial non-operative management. *Acta Neurochir (Wien).* 1993;121:100-8.
- Wong CW. Criteria for conservative treatment of supratentorial acute subdural haematomas. *Acta Neurochir (Wien).* 1995;135:38-43.
- Lee CH, Kang DH, Hwang SH, Park IS, Jung JM, Han JW. Spontaneous rapid reduction of a large acute subdural hematoma. *J Korean Med Sci.* 2009;24:1224-6.
- Bullock MR, Chesnut R, Ghajar J, Gordon D, Hartl R, Newell DW, et al. Surgical management of acute subdural hematomas. *Neurosurgery.* 2006;58:S16-24, discussion Si-iv.
- Fujimoto K, Otsuka T, Yoshizato K, Kuratsu J. Predictors of rapid spontaneous resolution of acute subdural hematoma. *Clin Neurol Neurosurg.* 2014;118:94-7.
- Son S, Yoo CJ, Lee SG, Kim EY, Park CW, Kim WK. Natural course of initially non-operated cases of acute subdural hematoma: the risk factors of hematoma progression. *J Korean Neurosurg Soc.* 2013;54:211-9.
- Kim BJ, Park KJ, Park DH, Lim DJ, Kwon TH, Chung YG, et al. Risk factors of delayed surgical evacuation for initially nonoperative acute subdural hematomas following mild head injury. *Acta Neurochir (Wien).* 2014;156:1605-13.
- Cosar M, Eser O, Aslan A, Ela Y. Rapid resolution of acute subdural hematoma and effects on the size of existent subdural hygroma: a case report. *Turk Neurosurg.* 2007;17:224-7.
- Wu MC, Liu JX, Luo GC, Zhang ZW, Min J, Yu H, et al. Rapid natural resolution of intracranial hematoma. *Chin J Traumatol.* 2004;7:96-100.
- Matsuyama T, Shimomura T, Okumura Y, Sakaki T. Rapid resolution of symptomatic acute subdural hematoma: case report. *Surg Neurol.* 1997;48:193-6.
- Balik V, Kolembus P, Svajdler M, Sulla I, Vaverka M, Hrabalek L. A case report of rapid spontaneous redistribution of acute supratentorial subdural hematoma to the entire spinal subdural space presenting as a Pourfour du Petit syndrome and review of the literature. *Clin Neurol Neurosurg.* 2013;115:849-52.
- Kapsalaki EZ, Machinis TG, Robinson JS 3rd, Newman B, Grigorian AA, Fountas KN. Spontaneous resolution of acute cranial subdural hematomas. *Clin Neurol Neurosurg.* 2007;109:287-91.
- Niikawa S, Sugimoto S, Hattori T, Ohkuma A, Kimura T, Shinoda J, et al. Rapid resolution of acute subdural hematoma - report of four cases. *Neurol Med Chir (Tokyo).* 1989;29: 820-4.
- Tsui EY, Fai MAK, Cheung YK, Chan JH, Yuen MK. Rapid spontaneous resolution and redistribution of acute subdural hematoma in a patient with chronic alcoholism: a case report. *Eur J Radiol.* 2000;36:53-7.
- Cohen JE, Eger K, Montero A, Israel Z. Rapid spontaneous resolution of acute subdural hematoma and HIV related cerebral atrophy: case report. *Surg Neurol.* 1998;50:241-4.
- Bortolotti C, Wang H, Fraser K, Lanzino G. Subacute spinal subdural hematoma after spontaneous resolution of cranial subdural hematoma: causal relationship or coincidence? Case report. *J Neurosurg.* 2004;100:372-4.
- Wong ST, Yuen MK, Fok KF, Yuen SC, Yam KY, Fong D. Redistribution of hematoma to spinal subdural space as a mechanism for the rapid spontaneous resolution of posttraumatic intracranial acute subdural hematoma: case report. *Surg Neurol.* 2009;71:99-102 [discussion 02].
- Ahn ES, Smith ER. Acute clival and spinal subdural hematoma with spontaneous resolution: clinical and radiographic correlation in support of a proposed pathophysiological mechanism. Case report. *J Neurosurg.* 2005;103:175-9.
- Liu B, Zhuang Z, Luo J. Fluctuation of intra-parenchymal cerebral pressure may drive the rapid spontaneous resolution of acute subdural hematoma. *Med Hypotheses.* 2013;81:159-62.
- Yadav YR, Agarwal M, Namdev H, Parihar V. Rapid resolution of acute subdural hematoma: a case report and review of literature. *Indian J Neurotrauma.* 2011;8:45-7.
- Izumihara A, Orita T, Tsurutani T, Kajiwaru K. Natural course of non-operative cases of acute subdural hematoma: sequential computed tomographic study in the acute and subacute stages. *No Shinkei Geka.* 1997;25:307-14.
- Cuatico W, Yamamoto R, Howeller B, Smith R. Spontaneous resolution of subdural hematomas. *J Neurosurg Sci.* 1991;35:139-45.
- Joki T, Hashimoto T, Akachi K, Boku M, Suzuki K, Nakamura N. Rapid resolution of acute subdural hematoma; report of two cases. *No Shinkei Geka.* 1992;20:915-9.
- Sato M, Nakano M, Sasanuma J, Asari J, Watanabe K. Rapid resolution of traumatic acute subdural haematoma in the elderly. *Br J Neurosurg.* 2005;19:58-61.
- Mirzai H, Yaldiz C, Eminoglu M, Orguc S. Neurological Picture Ultra fast resolution of acute post-traumatic subdural haematoma. *J Neurol Neurosurg Psychiatry.* 2005; 76:1738.
- Hadjigeorgiou G, Chamilos C, Petsanas A, Vranos G, Foteas P, Spiridakis F. Rapid spontaneous resolution of acute subdural

- 
- haematoma in a patient with chronic alcoholism. *Br J Neurosurg.* 2012;26:415-6.
30. Park JY, Moon KS, Lee JK, Jeung KW. Rapid resolution of acute subdural hematoma in child with severe head injury: a case report. *J Med Case Rep.* 2013;7:67.
31. Liu B, Zhuang Z. The cause and consequence of rapid spontaneous redistribution of acute subdural hematoma. *Clin Neurol Neurosurg.* 2013.
32. Shin DW, Choi CY, Lee CH. Spontaneously rapid resolution of acute subdural hemorrhage with severe midline shift. *J Korean Neurosurg Soc.* 2013;54:431-3.
33. Towers WS, Kurtom KH. Spontaneous resolution of large acute subdural hematoma and the value of neurological exam in conservative management of high risk patients. *Clin Neurol Neurosurg.* 2014;118:98-100.