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Case presentation

Case report and related comments in a relatively young male patient with right hemiplegia after left thalamo- mesencephalic hemorrhage and a consequent Parinaud syndrome – interdisciplinary therapeutic – rehabilitative approach

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ABSTRACT: Thalamo- mesencephalic hemorrhage is a devasting event, with a increased morbidity and mortality rate. Parinaud's syndrome, also known as the dorsal midbrain syndrome, is characterized by a supranuclear vertical gaze disturbing, resulting from an insult to the mesencephalic tectum. **Matherial and Method**. We report the case of a 45-year-old man with personal antecedents of arterial hypertension, obesity and type 2 Diabetus mellitus, who was first admitted in the Neurology Clinic Division of the Teaching Emergency Hospital Bucharest with a sudden onset of complete right hemiplegia, mixed aphasia and right central– type facial palsy on 17.04.2021, being diagnosed – following complex paraclinic investigations -with a left thalamo- mesencephalic hemorrhage. **Results and discusssion**. The patient followed a neuro- muscular rehabilitation program in our Neuro- Rehabilitation Clinic Division with favorable outcomes, the case representing a real challenge regarding the complexity of the factors involved. **Conclusions.** The clinical outcomes and the quality of life of patients suffering from thalamo- mesencephalic hemorrhage depend both on the prompt diagnosis and the efficient treatment, followed by an appropriate rehabilitation program.

Keywords: *neuro-rehabilitation, thalamo-mesencephalic hemorrhage, Parinaud syndrome*

1. INTRODUCTION

Hemorrhagic stroke is bleeding in the brain parenchyma, due to a ruptured normal or abnormal blood vessel, determining the sudden reduction of blood supply in the brain area (stroke) and the accumulation of blood in the brain tissue (hemorrhage/hematoma) with consequent events (1): mechanical damage associated with the mass effect, cytotoxicity of blood, hypermetabolism, excitotoxicity and oxidative stress and inflammation.
Clinically, most common symptoms and signs are: headaches, oculomotor disturbances, sensitive deficits, cerebellar involvement (ataxia, dysmetria, dysarthria), mental status disturbances (drowsiness, stupor, coma), dysphagia and motor deficits.
Brain vascular malformations are the leading cause of intracerebral hemorrhage (ICH) in young adults (2). Other secondary mechanism for ICH include: oral anticoagulants: warfarin/ coumarin derivates overuse, brain trauma, brain tumor complications. (3)
Primary causes are arterial hypertension, cerebral amyloid angiopathy. Cerebral amyloid angiopathy refers to the accumulation of β-amyloid in the media and adventitia of mostly cortical vessels, which can lead to leakage of blood through the vessel wall (4).

Vascular risk factors for developing an ICH are: smoking, alcohol abuse or diabetes mellitus. Intracranial vascular malformations (IVM) are: arterial aneurysms, brain arteriovenous malformations (BAVM), cavernous malformations (CM), dural arteriovenous fistula (DAVF).

Intracranial vascular malformations (IVM)			
Arterial aneurysms	Brain arterio-venous malformations (BAVM)	**Cavernous malformations (CM)**	Dural arteriovenous fistula (DAVF)

Table 1: IVM

Most common VM underlying ICH are BAVM and CM. Cavernous malformations (CM) are low-flow vascular (BAVM=high flow) lesions that are made up from sinusoidal spaces lined by a single layer of endothelium and separed by a hyaline matrix (without interposed brain tissue). (3,5) Regarding the natural history, CM occur in sporadic or familial forms.(6)

Most cavernous malformations have a benign natural history, but they may produce clinical symptoms such as: seizures, headache, focal neurological deficits and even hemorrhagic strokes. (3)

Comparing CM to other AVM in hemorrhagic stroke, in a recent study (2) the results have shown that intracranial hemorrhages caused by CMs occurred at younger ages and were less disabling than those produces by other VM (BAVM/ DAVF) and were also, purely intracerebral without intraventricular involvement.The authors concluded that a few other studies described patterns of hemorrhagic extension due to CMs rupture.

Parinaud's syndrome (7)

It is also known as dorsal midbrain syndrome and it consist of: paralysis of upgaze and accommodation, eyelid retraction (Collier sign), loss of pupillary reflex to light/ distance and convergence- retraction nystagmus. Patients complain of difficulty looking up, blurred near vision, diplopia and neurological symptoms. (8,9)

Syndromes of the midbrain have many potential etiologies, but Parinaud's syndrome occur mainly due to tumors compressing structures around the midbrain. (9)

Treatment is focused on the underlying cause and may require surgery or medication. (8)

MATERIAL AND METHODS

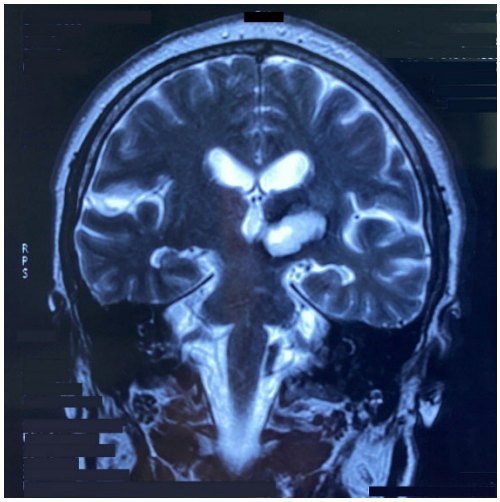
Having the patient's consent, this paper presents the case of a 45-year-old male with cardiovascular risk factors (arterial hypertension, type 2 diabetes mellitus treated with oral hypoglycaemic drugs, class III obsesity) admitted in our Neuromuscular Rehabilitation Clinical Division with: mental status disturbances (cerebrasthenia), slight dysarthria, right central facial palsy, right hemiplegia (complete brachial and crural motor deficit) and severe selfcare and locomotor dysfunction.

This case presentation received the TEHBA Ethics Committee approval No 24389/28.06.2021.

From his personal pathological history, there are to be mentioned: arterial hypertension, type 2 diabetes mellitus treated (oral hypoglycaemic drugs) and class III obsesity.

The patient was also, diagnosed with left thalamus and midbrain hemorrhagic stroke 4 weeks before the admission in our Clinical Divison (CT-examination) and followed antiplatelet drug, two antihypertensive drugs, beta-blocker and oral hypoglycaemic drug.

General examination: At admission, he was afebrile, in poor general state, with dehydrated skin, conscious but with altered mental status (cerebrasthenia), class III hyperplasic type obsesity, normal stetacustic respiratory and cardiovascular examination, BP=120/75 mmHg, HR=72 b/min, SpO2 (peripheral oxygen saturation) = 93%, without signs of neurogenic bladder/bowel: delayed intestinal transit time, normal micturition.
Neuro- mio- arthro- kinetic examination: the patient was temporo- spatial oriented, without signs of meningeal irritation, the cranial nerves examination revealed oculomotor disturbances: vertical eye movements palsy, horizontal eye movements with nystagmus, decreased pupillary light reflexes bilaterally (right eye almost abolished), dyplopia, right central facial palsy. No dysphagia. He had right hemiplegia with complete loss of motor control (0/5 MRC upper and lower limbs), external rotation of the right lower limb, no hypo/anesthesia, no proprioceptive or nociceptive impairments.
Functionality: He had the ability of self-transfering into sitting posture, with balance and tolerance for few minutes with hand support.
Laboratory findings: hyperuricemia : 7.7 mg/dL (RI=3.5-7.2 mg/dL), Iron deficiency anemia: iron: 60 µg/dL , Hg=13.4 g/dL (RI=65-175 mcg/dL ; RI Hg=14-18 g/dL), inflammatory syndrome: CRP = 0.57 mg/dL, ESR=42 mm/h(RI CRP=0-0.5 mg/dL RI ESR=3-8 mm/h), hypertriglyceridemia : 216 mg/dL(RI=0-149 mg/dL), hypo-HDL: 18 mg/dL (RI=40-60 mg/dL).
Brain MRI findings: Left thalamus and midbrain intraparenchymal hematoma (blood in the methemoglobin stage) with peripheral hemosiderin ring in T2 signal, maximum dimensions of 18.6 / 25.3 / 18.4 mm, present minimal neighborhood edema, discrete mass effect on the left lateral ventricle, without shift of the midline.
SWAN sequence (susceptibility-weighted angiography) revealed multiple round-oval images, with infra- and supratentorial topography, the largest (4 mm) in the right pons – cavernomas



1. Left thalamus and midbrain intraparenchymal hematoma: (blood in the methemoglobin stage), with a peripheral ring (hemosiderin), and maximum dimensions of 18.6 / 25.3 / 18.4 mm.
2. Multiple subcentric and supratentorial cavernomas. The largest (4 mm) right pontine - cavernous.

Fig 1: MRI aspect at admission

Functional assessment: the patient was clinically and functionally assessed, according to the standardized protocols implemented in our clinic by means of the folowwing assessment grading scales:

- Cognitive assessment: MOCA (Montreal cognitive assessment) scale (10)
- Disability: modified Rankin score (11), extended GOS (12)
- Muscle spasticity: modified Asworth scale (13) ; Penn spasm frequency scale (14)
- Ambulation capacity: FAC scale (15)
- Activities of daily living: Barhel index (16)
- Quality of life: QOL (modified after Flanagen) (17)

During hospitalisation, the patient underwent a complex recovery program which included pharmacological treatment: antiplatelet drug, two antihypertensive drugs, beta-blocker, oral hypoglycaemic drug, neurobiotrophic drugs oral + i.v, urinary anstiseptic drugs, physical treatment (kinesiotherapy) and ergotherapy.
The main general objectives of rehabilitation program were: patient's psycho-cognitive/ mental and emotional status improvement, speech disorder improvement, therapy of associated diseases, improvement of QoL and familiar and social integration.
Kinesiotherapy objectives included: motor deficit improvement: progressive neuromuscular reeducation and muscle control increase, management of muscle spasticity, gait training strategies, improving of functional hand ability: repetitive task training and ocupational therapy, cardiorespiratory rehabilitation and improvement of self-care.
Furthermore, the therapeutic approach bases on the hygienic- dietary regime consisting in low-sodiu, low- carbohydrate, and low-lipid diet, rich in vitamins and minerals and maintainance of adequate nutrition and hydration (1,5-2l/ day). Our patient should avoid skin contact with any hot liquids or objects.

Physical therapy

Until full mobilization, we recommended a kinetic bed-side programme: body positioning and passive - prolonged stretching / passive-active / active exercises for upper and lower limbs. After complete mobilization, he performed passive- active (Motomed) and active exercises (with various instruments) for training of trunk, scapular and pelvic girdles, every segment of upper and lower limbs (sinergies).
Rehabilitation is the key to regain the ability to walk after stroke, working by stimulating the brain with various physical exercises under the supervision of the therapist. For example: walking exercises with hand support and also from physical therapist, for our patient, helped him in progressive restoring movement.
Ergotherapy is an important part of rehabilitation and involves re-learning of daily activities. It consists in passive/ passive-active mobilization of the upper limbs; active exercises for plegic upper limb segments: shoulder abduction, adduction, flexion and extension, elbow flexion and extension, wrist flexion and extension, hand supination/ pronation, finger and hand gripping exercises.

Evolution

After 1 month from hospital admission, he had weak movement (1/5 MRC) of right thumb, finger flexion (2/5 MRC), forearm / arm flexion and extension (2/5 MRC), right upper limb muscle strenght (2-3/ 5 MRC) in the proximal segments and (2/5 MRC) in the distal segments.
The patient was trained, as well, with verticalization exercices at the stall bars, (he had a weak hip flexion 1/5 MRC), he walked between parallel barrs with support from physical therapist (his right lower limb muscle strenght was 3/5 MRC in the proximal segments and 0/5 MRC in the distal segments) and walked with support in tripod cane.
There are to be noticed also, the improvement of dysarthric speech, a better pshychological state, a good central facial paresis recovery: wide smile possible.
However, the spasticity remained 2/4 mAshword scale at right upper and lower limbs.
After 3 month from acute stroke: regarding the motor deficit, he had a 3/5 MRC at right upper limb and 4/5 MRC at right lower limb, with a spasticity of 2/4 mAsword at right limbs.
Oculomotor dysfunction evolution: we could notice oculomotor disturbances improvement: upward eye movements were possible asocciated with nystagmus, horizontal eye movements with nystagmus, present although low - right eye decreased pupillary light reflexes (normal left eye reflexes), dyplopia was in remission, very discrete right central facial palsy.

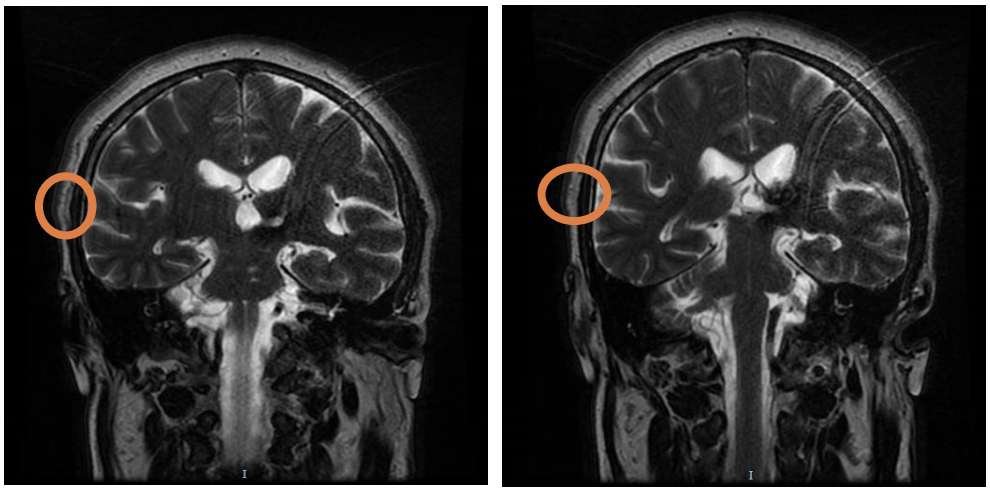


Fig 2: MRI aspect after 3 month from acute stroke

Results after first hospital admission

Cognitive asessment	Spasticity	Muscle strenght	Disability	Ambulation	Activities of daily living
MOCA scale	mAsworth scale	Total MRC right limbs	mRankin scale	Functional ambulation categories	Barthel index
14/25 **(56%)**	1/4 right upper and lower limbs	Upper limbs 0/25 → **13/25**	5/5 → **4/5**	0/5 → **2/5**	15/100 → **50/100**
		Lower limbs 0/25 → **6/25**			
	Penn scale		GOS-e scale		
	1/4 right upper and lower limbs		3/8 → **4/8**		

Cognitive asessment	Spasticity	Muscle strenght	Disability	Ambulation	Activities of daily living
MOCA scale	mAsworth scale	Total MRC right limbs	mRankin scale	Functional ambulation categories	Barthel index
27/30 **(90%)**	2/4 right upper and lower limbs	Upper limbs → **15/25**	→ **3/5**	→ **4/5**	→ **70/100**
		Lower limbs → **19/25**			
	Penn scale		GOS-e scale		
	2/4 right upper and lower limbs		→ **5/8**		

DISCUSSION

Patient's 3 month evolution was favourable, regaining good walking abilities with normal cane and having a complete independence for toilet use and personal hygiene. From the point of view of hand functionality, he became independent in eating and basic self-care.

Further neuro-muscular rehabilitation is needed in order to complete walking abilities (without hand support), to improve balance and coordination and as well, hand functionality.

Our patient had many vascular risk factors: arterial hypertension, obesity, diabetes mellitus and suffered a thalamic and midbrain hemorrhagic stroke. The young age highlighted the need for further investigations. CMs were observed supra and infratentorial brain areas and the biggest was noticed in the right pontine area, near the location of the hemorrhagic stroke.

In a clinical retrospective study (18) including patients with brain stem cavernomas and ICH, "most haemorrhagic recurrences occured within 5 years, with a clear tendency to be more frequent in the first two years" and "lesion size > 18 mm was associated with major risk of rebleeding".

Although the patient's ad functionam prognosis is good so far, regular medical visits are needed in order to detect any form of neurologic aggravation such as seizures or headache.

Vascular risk factors that need to be monitored and controlled are: blood pressure, diabetes mellitus, and the alcohol abuse (the patient denies alcohol consumption). Cholesterol levels seem to be associated with lower risks ICH. (19,20,21)

Further genetic investigations are needed to diagnose a possible familial form of CM: CCM genes (I-III). MRI screening of the kins (especially children) might be neccesary in order to clear/confirm the same lesions and acces an informed medical advice.

CONCLUSIONS

Hemorrhagic strokes account for a minority of the total strokes, still they are associated with high morbidity and the risk of reccurence (22-28).

In young patients VM, particulary CMs, predispose to serious neurologic comorbidities: seizuires, focal deficitis, hemorrhagic strokes.

Studies point out that hemorrhagic strokes caused by CMs are less disabling than those produces by other VM (6), still the risk of recurrence is high in the first two years after such an accident (18). These recurrences may be more frequent if the lesion size is large (> 18 mm) (18) and are influenced by uncontrolled BP, diabetes mellitus, smoking, alcohol abuse.

Surgical treatment options are indicated if the risks of bleeding are high, but are limited only to superficial brain areas. (18).

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