Introduction

Syncope related to a particular circumstance is called situational syncope [1]. It is a type of neurally mediated syncope (NMS) triggered by usual or unusual circumstances. Usual circumstances that trigger situational syncope (SS) include micturition, defecation, swallowing, cough and sneeze. Instrumentation, pressure on the eyeball and traction on the extraocular muscles are examples of unusual precipitating stimuli [1, 2]. The pathophysiology of NMS is poorly understood [3]. It is believed that efferent pathways are identical among NMS and situational syncope, leading to vasodepression and cardioinhibition. The “afferent” inputs are, however, presumed to be different: neocortical and limbic structures play a key role in NMS; whereas, SS is attributed to activation of afferent impulses from a particular organ (e.g., vagal afferents from the esophagus in cases of swallow syncope) [2, 4]. This assumption is supported by the findings of the organ or nerve pathology, and by the knowledge of existing viscerovisceral and somato-visceral reflexes. Organ pathology has been reported in patients with swallow syncope who had carcinoma of the esophagus. Similarly nerve pathology in the form of malignant infiltration of the glossopharyngeal nerve, combined with demyelination of the vagus nerve has been demonstrated [1, 5, 6]. Association between acute herpes zoster ophthalmicus and syncope has also been observed [7]. Furthermore, trigeminal-brainstem-vagal reflexes have been used for diagnostic and therapeutic purposes [8, 9, 10]. These observations suggest a significant role of local afferents but there are no systematic studies to establish a direct causal relationship. The present case of a woman who consistently developed syncope during eye examination provided an opportunity to investigate the role of trigeminal afferents in SS.

Materials and Methods

Case Report

A 51-year-old woman experienced approximately ten episodes of fainting since the age of twelve, which were triggered by venipuncture...
and heat. Her eye examination was always complicated by a fainting spell. A typical episode began with prodromal lightheadedness, loss of vision, and pale face. A fainting spell usually lasted for about two minutes and was occasionally accompanied by tonic-clonic movements. Immediately after fainting, she noted facial pallor, diaphoresis, and on occasions urgency of bowel movement. She also reported intermittent, patchy or diffuse, flushing affecting her face, neck, and chest occurring several times a day and lasting for a variable duration of a few minutes to six hours. It was unrelated to her fainting spells. She had a life-long history of mild orthostatic intolerance.

The patient’s father had Raynaud’s phenomenon. Her mother and brother suffer from migraine. Her son has a history of fainting spells.

General physical and somatic neurological examination including function of trigeminal nerves, were normal. The pupillary responses to light and sensory evaluation of the trigeminal nerves including corneal reflexes did not produce any symptoms. A bedside autonomic evaluation demonstrated cold extremities, orthostatic reddish discoloration of the lower limbs, and flushing of the face, ears, and the upper chest.

Tests including complete blood counts, routine blood chemistries with glucose; thyroid function tests; 24-hour urine for hydroxyindole acetic acid; electrocardiogram and magnetic resonance imaging of the brain were normal.

**Methods**

The heart rate was monitored continuously by a heart rate monitor. Blood pressure was measured by means of Ohmeda Finapres 2300, a plethysmographic device that produces continuous, non-invasive, beat-to-beat determination of finger arterial pressure. An electrically operated table with foot support was used to produce the postural stress.

Cardiovagal function was evaluated in response to three physiologic stimuli: the heart rate response to six deep breaths per minute, the Valsalva maneuver, and the cold face test [9, 11, 12]. Blood pressure response to the Valsalva maneuver and the tilt-table test assessed sympathetic adrenergic function [12, 13]. The technique and interpretation of these standard tests used, were reported previously with normative data.

On a separate day, the contribution of trigeminal stimulus to SS was investigated, with subject in the sitting position. The heart rate and blood pressure responses to the application of Schirmer’s lacrimation test strips in both conjunctival sacs were recorded. These strips were inserted into the inferior fornices of the conjunctival sacs. Ocular pressure was specifically avoided so as not to elicit the oculocardiac reflex [14]. Following recovery from the procedure, cardiovascular responses to the percutaneous supramaximal stimulation of the supraorbital nerves were evaluated. Subsequently, two drops of proparacaine hydrochloride (0.5%) were instilled into each conjunctival sac every three minutes for three doses. Three minutes after the last dose, ocular anesthesia was confirmed by the absence of corneal reflexes. The heart rate and blood pressure responses to the lacrimation test strips and to the supramaximal stimulation of the supraorbital nerves were restudied.

**Results**

Autonomic evaluation did not provide evidence of excess vagal activity (Table 1). The presence of late phase 2 and a systolic blood pressure overshoot of 30 mm Hg in response to the Valsalva maneuver indicated normal sympathetic activity [15]. Before the tilt, the patient had a blood pressure of 160/100 mm Hg and a heart rate of 75 beats per minute. She had no history of hypertension.

### Table 1: Cardiovagal function tests results

<table>
<thead>
<tr>
<th>Tests</th>
<th>Normal values</th>
<th>Patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart rate response to deep breathing</td>
<td>25.63±2.3 SE</td>
<td>14.3</td>
</tr>
<tr>
<td>Valsalva ratio</td>
<td>1.76±0.03 SE</td>
<td>1.62</td>
</tr>
<tr>
<td>Cold face test</td>
<td>% Bradycardia</td>
<td>6.25%</td>
</tr>
<tr>
<td></td>
<td>21.4±16.6SD</td>
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</tbody>
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Head-up tilt produced facial flush and a biphasic cardiovascular response. At three minutes, she had a blood pressure of 220/140 mm Hg and a heart rate of 90 beats per minute. At 8.5 minutes, she became flushed and pre-syncopeal with a blood pressure of 90/60 mm Hg and a concomitant decrease in heart rate to 80 beats per minute, requiring termination of the test (Fig. 1).

In brief, these tests demonstrated the patient’s susceptibility to NMS without any evidence either of excess vagal activity or of sympathetic insufficiency. The cardiovascular responses to the Valsalva maneuver provided evidence of normal baroreflex function.

The application of Schirmer’s lacrimation test strips into the conjunctival sacs reduced blood pressure from 170/80 mm Hg to 90/60 mm Hg in less than 30 seconds, without any decrease in heart rate. Within 5 minutes the blood pressure declined to 60/30 mm Hg and the heart rate decreased by 20 beats per minute (Fig. 2). The test was discontinued. The patient remained supine for seven minutes before her blood pressure rose to 100/50 mm Hg. After full recovery, ocular anesthesia was achieved with topical administration of proparacaine.

Following anesthesia, the application of lacrimation strips into the conjunctival sacs made her dizzy and lowered her blood pressure from 230/150 mm Hg to 180/120 mm Hg within 30 seconds. Her heart rate was diminished by 10 beats per minute. Within 1.5 minutes her blood pressure was down to 90/60 mm Hg. Her heart rate had lessened by 20 beats per minute (Fig. 3).

The patient complained of pain and showed a flushed face in response to right and left supraorbital nerve stimulation but no significant changes in blood pressure or heart rate were observed, neither before nor after the ocular anesthesia.

**Discussion**

The history and results of the head-up tilt test were consistent with the diagnosis of NMS. Onset in her teens, association with venipuncture, family history, and prodromal as well as post-ictal phases of the episode favored the diagnosis. A head-up tilt test substantiated this diagnosis. In addition, her syncope was precipitated by eye examination. She volunteered information regarding this situational trigger when her eyes were examined. This response was documented by inserting lacrimation