



# Acute hemiparesis and status epilepticus following endoscopic esophageal balloon dilation: is it really a stroke?

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## Abstract

A 68-year-old gentleman was referred for elective upper gastrointestinal endoscopy on a background of dysphagia and esophageal candidiasis. A benign peptic stricture was noted, managed with balloon dilation without apparent immediate complication. At completion, however, the patient became confused and agitated, with no improvement despite the reversal of sedation. Two hours later, with all investigations for suspected complications including perforation, negative, he developed acute left-sided hemiparesis. Urgent computed tomography brain and angiogram were both normal. A diagnosis of acute ischemic stroke was made, and the patient was thrombolysed in the Intensive Care Unit. No improvement of the stroke was observed. Seven hours later, the patient developed generalized tonic-clonic seizures that required phenytoin infusion and subsequent intubation and ventilation. The following morning, magnetic resonance imaging brain did not reveal features of a stroke, but instead diffuse cortical and white matter edema in the right frontal lobe, consistent with atypical, unilateral Posterior Reversible Encephalopathy Syndrome (PRES). Signs and symptoms resolved rapidly over the course of several days, and after one month the patient made a complete clinical and radiological recovery. To our knowledge, this is the only case of PRES to arise in the setting of endoscopy and esophageal dilation.

**Keywords** Endoscopy · Balloon dilation · Esophageal stricture · Stroke · Posterior Reversible Encephalopathy Syndrome (PRES)

## Introduction

Posterior reversible encephalopathy syndrome (PRES), is a clinical-radiographic syndrome of heterogeneous etiologies, characterized by acute neurological symptoms arising as a result of vasogenic brain edema. Though rare, it is increasingly recognized, largely due to the increased availability of magnetic resonance imaging (MRI) [1]. PRES can arise in a variety of contexts, though is most often associated with hypertension, pre-eclampsia/eclampsia, renal

disease, auto-immune conditions, sepsis, organ transplant, malignancy, and use of cytotoxic/immunosuppressive drug therapies [2]. The most common presenting features are encephalopathy, seizures, headache, visual disturbance, focal neurological deficit, and status epilepticus [1]. Though the exact pathophysiology is not fully understood, endothelial dysfunction with subsequent breakdown of the blood–brain barrier (BBB) is known to play a key role [1]. The radiographic features are classically described as bilateral subcortical and cortical hyperintensities seen predominantly in the parieto-occipital regions on fluid-attenuated inversion recovery (FLAIR) MRI sequences [3]. While there is no specific treatment for PRES, complete resolution both clinically and radiographically is seen in up to 90% when the precipitating cause is treated or eliminated [1]. In rare cases, however, cerebral hemorrhage or ischemia may cause irreversible neurological damage or even death [4].

We present a highly unusual case of PRES that occurred following balloon dilation of a benign esophageal stricture.

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## Case description

A 68-year-old gentleman walked into the gastrointestinal (GI) day unit for an elective endoscopic balloon dilation, on a background history of recent dysphagia. His past medical history was notable for Crohns disease (quiescent for over 15 years), recurrent angio-edema, and chronic back pain. His regular medications included lansoprazole, gabapentin, and fexofenadine.

Standard sedation with intravenous (IV) midazolam 5 mg was used, and a benign esophageal peptic stricture was noted within a hiatus hernia (Fig. 1). The stomach and duodenum were both normal, and the esophageal stricture was not believed to have been Crohns related. The stricture was dilated using a through the scope (TTS) balloon, inflated to 20 mm diameter without apparent immediate complication. At completion, however, the patient's level of consciousness decreased significantly. Sedation was promptly reversed with flumazenil but to no significant avail. Blood pressure (BP) was elevated at 168/80 mmHg, with other vital signs within normal limits. Despite supportive measures, the patient became distressed with fluctuating levels of consciousness, and shortly after the procedure developed new neck pain. Esophageal perforation was promptly ruled out both clinically and on chest X-ray. Two hours later, the patient was noted to have a new dense left hemiparesis, left facial droop and severe left hemineglect. Urgent computed tomography (CT) brain and angiography showed no evidence of hemorrhage, intracranial lesion, arterial dissection or air embolism. Laboratory investigations at this time were also unremarkable. A clinical diagnosis of acute ischemic stroke was made by the on-call Vascular Neurologist, and the patient was transferred to the intensive care unit (ICU) for thrombolysis.

Seven hours post-thrombolysis the patient developed two tonic-clonic seizures; the first focal involving the left upper limb, and the second generalized. With no resolution following IV midazolam and loading doses of phenytoin, the patient eventually required intubation and ventilation with propofol for sedation. A second CT brain was again unremarkable.

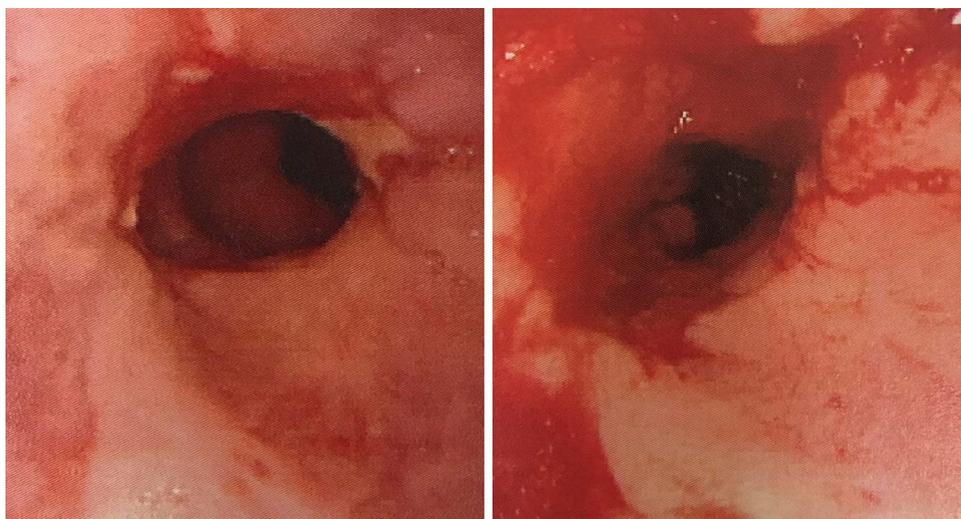
Later that morning the patient was sent for MRI brain. To our surprise, the MRI findings were not consistent with cerebral ischemia, but instead revealed diffuse cortical and white matter edema throughout the right hemisphere (Fig. 2A). There was no hemorrhage, mass/mass effect, restricted diffusion or reduction in ADC signal. The patient was extubated later that day and his condition improved over the next 24–36 h. Repeat MRI brain two days post-procedure showed more extensive white matter edema (Fig. 2B), and the radiology opinion was that the imaging features were “*highly unusual*” and “*may relate to Posterior Reversible Encephalopathy Syndrome*”. This view was supported by Neurology, who felt that findings were consistent with atypical unilateral PRES.

The patient's overall condition and neurological signs quickly improved, and he was discharged home on day 14 to pursue ongoing physiotherapy and occupational therapy in the community. MRI brain at ten days showed substantial improvement in the subcortical white matter edema (Fig. 2c), and by four weeks, both clinical and radiological signs had completely resolved (Fig. 2d).

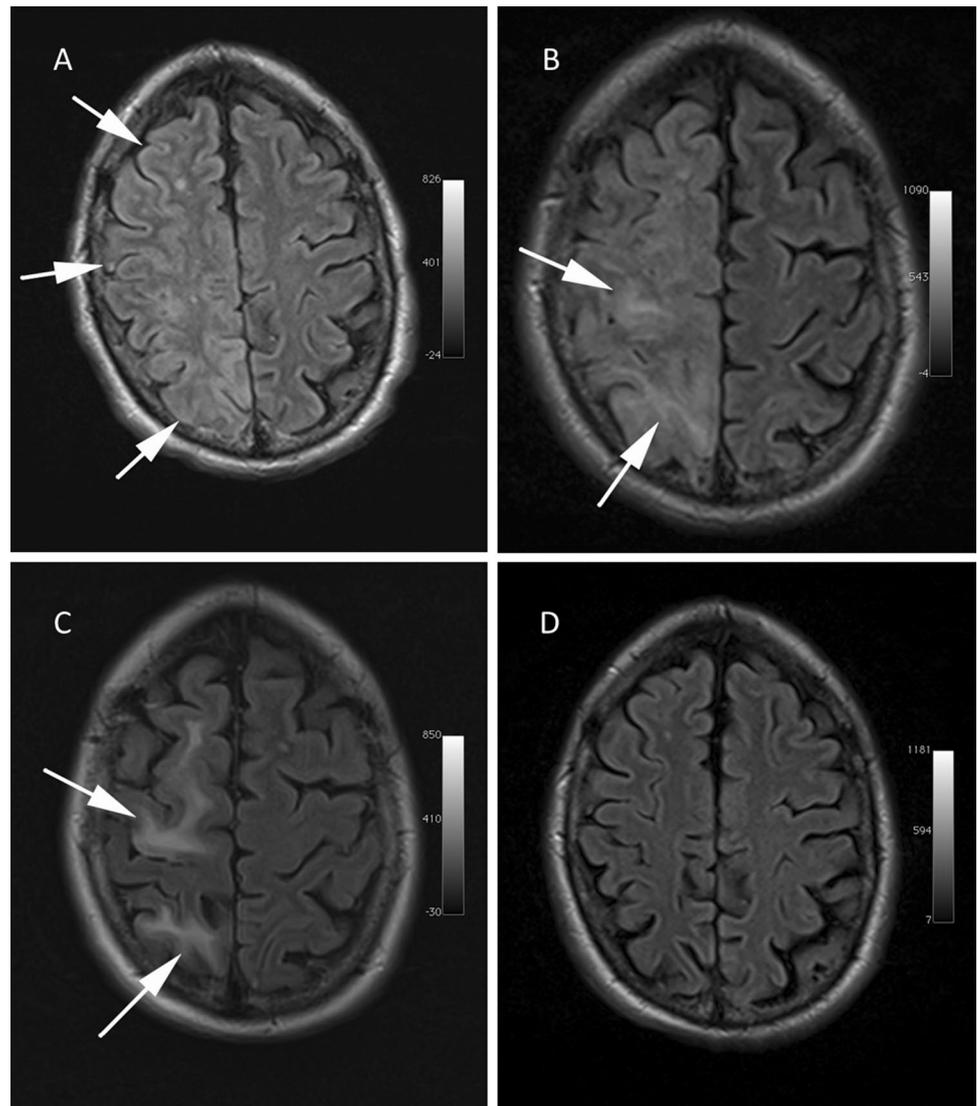
## Discussion

To our knowledge, no other case of PRES has occurred in the context of upper GI endoscopy or esophageal balloon dilation. Typically, complications of endoscopy relate either

**Fig. 1** Esophageal stricture within a hiatus hernia noted on endoscopy



**Fig. 2** **a** Axial FLAIR MRI day 0, Diffuse cortical and white matter edema of right frontal lobe (arrows). **b** Axial FLAIR MRI day 2, More extensive white matter edema than when compared to prior study (arrows). **c** Axial FLAIR MRI day 12, Cortical edema in right frontal lobe almost completely resolved. Some persistent sub-cortical edema (arrows). **d** Axial FLAIR MRI day 61, Complete interval resolution of both cortical and white matter edema



to sedation, endoscopy itself, or any therapeutic intervention performed. Sedation-related complications are usually cardiopulmonary and include respiratory depression, hypoxemia, hypotension, and aspiration [5]. Hypotension can result not only from the vasodilatory effects of sedative medications but also from vagal stimulation and subsequent bradycardia [6]. Conversely, hypertension is also commonly seen, usually in response to anxiety or discomfort caused by the procedure itself [6]. Thus, a certain amount of blood pressure flux is common. Complications relating specifically to esophageal stricture balloon dilation include perforation, hemorrhage and bacteremia [6]. Our biggest concern at time of procedure was esophageal perforation. Although very rare, the mortality rate is high at 2–36% [7]. Our suspicion for perforation was soon allayed, however, by a lack of other correlating clinical signs and radiographic findings. Events then became even more alarming when the patient developed sudden, dense left hemiparesis. In the context of neck

pain, carotid/vertebral artery dissection was considered. This, however, was also ruled out following a normal CT angiogram and brain. With all clinical data pointing toward an acute ischemic stroke, the patient was then thrombolysed under the supervision of a Consultant Neurologist. Having started as an elective day-case procedure, for the patient to ultimately arrive at ICU requiring intubation and ventilation was, in our experience, unprecedented. It was only after utilization of MRI that a diagnosis of PRES began to materialize, which was further reinforced by the patient's rapid recovery.

With improved availability of MRI, PRES is becoming increasingly recognized in a broad variety of clinical scenarios. It is important to maintain a high clinical suspicion of PRES when faced with acute/subacute neurological symptoms that appear out of context or otherwise unexplained. While encephalopathy and seizure are the most common presenting features of PRES [1], atypical presentations

such as this are increasingly reported [8]. Focal neurological deficits are seen in up to 15% [1], however, there are exceptionally few other cases where PRES has mimicked an acute stroke so convincingly. Indeed, we can find no other case where the patient was ultimately thrombolysed, such was clinical impression of stroke so incontrovertible. Other differentials worthy of mention are cerebral air embolism and intra-cerebral hemorrhage. With only five published cases in the literature, cerebral air embolism is considered an exceptionally rare but recognized complication of endoscopic esophageal dilation. Likewise, there is only one case in the literature which describes intra-cerebral hemorrhage following endoscopy for removal of a benign gastric polyp. In this case, the authors attribute the intra-cerebral hemorrhage to an acute transient rise in blood pressure, thought to be secondary to the stress of the procedure, and/or systemic absorption of adrenaline used in hemostasis. In our case, however, no radiological evidence of either air embolism or hemorrhage could be found on any of the imaging modalities used.

Why endoscopy or esophageal dilation should trigger a unilateral PRES is not clear. PRES is thought to result from endothelial dysfunction and is most often seen in the settings of acute hypertension, systemic inflammatory processes, and cytotoxic drug use. There are two main theories for the pathophysiological mechanisms of the condition. The first, is that rapidly evolving or fluctuating BP levels exceed the upper limits of cerebral autoregulation, resulting in breakdown of the BBB, cerebral hyperperfusion, and vasogenic edema [1]. Moderate to severe hypertension is present in 50–70% of cases at symptom onset, and active reductions in BP are associated with clinical improvement in nearly all cases [9]. Our patient was indeed acutely hypertensive during the procedure, with BP increasing from 126/76 mmHg (mean arterial pressure [MAP] of 93 mmHg) at baseline to a peak of 168/101 mmHg (MAP 123 mmHg) over the course of 10 min. This represents only a modest increase in MAP, however, which itself would not be sufficient to exceed the normal autoregulatory capacity of 150–160 mmHg [9]. Another, more well supported theory is that circulating cytokines, as part of a systemic inflammatory state, cause direct injury to the cerebral endothelium, leading to increased vascular permeability and subsequent edema [1]. These systemic processes are common to many of the conditions now known to be associated with PRES, and recent studies have shown approximately 50% of PRES to be associated with an underlying autoimmune condition [1, 2]. Although our patient was known to have Crohns disease, it is unlikely to have precipitated PRES in this instance, as it had been dormant for over 15 years.

Finally, the strictly unilateral neuroimaging features demonstrated by this case were highly atypical. Classically, PRES is diagnosed based on bilateral hyperintensities

on FLAIR sequences in the parieto-occipital cortical and subcortical areas [3]. Previously considered atypical, it is now known that frontal lobe, temporal lobe, cerebellum, basal ganglia, brain stem and deep white matter are often involved [3]. It was not until 2007, however, that a study of 76 patients described a new unilateral variant, the incidence of which it reported at 2.6% [3]. Purely unilateral PRES is exceptionally rare. Some authors offer the explanation that asymmetric findings may relate to differences in arterial anatomy, pre-existing vascular disease, or regional hemispheric involvement in the underlying toxic process [10].

## Conclusion

This is the only case of PRES, to our knowledge, to be precipitated by upper GI endoscopy/balloon dilation. While a certain degree of blood pressure flux is to be expected during these procedures, it would not be of the magnitude sufficient to exceed normal cerebral autoregulatory mechanisms. Current evidence in the literature suggests that the hypertension/hyperperfusion theory does not adequately explain PRES [11], and this case is in keeping with that trend.

This case further adds to the growing list of precipitants and manifestations of PRES. Thus, the possibility of PRES should be considered when faced with acute neurological symptoms such as altered mental status, seizures, headache, visual disturbances and focal neurological deficits following endoscopy. With increasing availability of MRI, its early use should be prioritized in this context. With prompt diagnosis, inappropriate therapies such as thrombolysis may potentially be avoided.

## Compliance with ethical standards

**Conflict of interest** Dr. Nicholas Di Mascio, Professor Padraic MacMathuna, Professor Sean Murphy, and Professor Eoin Carl Kavanagh declare that they have no conflict of interest.

**Human/animal rights** All procedures followed have been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

**Informed consent** Informed consent was obtained from all patients for being included in the study.

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