

## Case Report

### A patient with right striatocapsular stroke complicated by relative adrenal insufficiency

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**Source of submission:** Prepared specifically for AMSJ

**160 Character summary:** A case report of a 74-year-old male, retired agricultural worker, who presented with a right hemispheric stroke syndrome complicated by relative adrenal insufficiency.

**Keywords:** stroke, relative adrenal insufficiency, hyponatraemia

**Table/Figure:** 0 Tables, 7 Figures

**Word count:** 1469 words

## Abstract

**Introduction:** Relative adrenal insufficiency can occur throughout the progression of critical illness and is generally transient.

**Case:** This case report describes a 74 year-old male with right hemispheric stroke syndrome on a background of multiple cardiovascular risk factors. A CT scan showed no acute change. An MRI scan revealed an acute right striatocapsular infarction. No acute therapies (thrombolysis or endovascular clot retrieval) were performed, as the time of symptom onset was unknown (patient awoke with symptoms). One week later, hyponatraemia was noted with a concurrent decline in function. A repeat MRI showed no interval change or haemorrhagic transformation to account for the functional decline. Complications included relative adrenal insufficiency, diagnosed presumptively and managed with cortisone, and gait instability managed with rehabilitation and allied health input.

**Discussion:** We review the literature concerning the association between acute ischaemic stroke and adrenal insufficiency and the clinical and biochemical overlap in our patient. This case report aims to increase awareness of relative adrenal insufficiency following a stroke and provide a discussion of possible mechanisms.

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## **Introduction**

Abnormal changes in the hypothalamic pituitary adrenal (HPA) axis have been reported in patients during the initial post-stroke phase [1]. Adrenal insufficiency has been shown to affect between 10 – 77 % of medical patients who are critically ill [2-4]. The term “relative adrenal insufficiency” is used to define inadequate production of corticosteroids in periods of severe illness in the absence of structural abnormalities in the HPA axis [5]. Here, we report the case of relative adrenal insufficiency detected in a patient with an ischaemic stroke following an otherwise unexplained clinical deterioration.

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## The Case

A 74 year-old male retired agricultural worker presented to the emergency department of a small rural hospital (< 10 beds) with left-sided weakness and difficulty speaking, with symptoms first noted upon waking at 7am that morning. On examination, he was unable to raise his left arm, had weakness in the left leg compared to the right, dysarthria, dysphagia, left-sided facial droop, and left-sided tongue deviation. He had difficulty with upward gaze; however, visual fields were intact. No acute therapies (thrombolysis or endovascular clot retrieval) were performed, as time of symptom onset was unknown. He was transferred to a regional health campus, where a CT Brain showed no acute intracranial pathology. His National Institutes of Health Stroke Scale (NIHSS) score was 10.

On admission, his blood pressure was 148/61 mmHg, blood glucose level was 6 mmol/L, serum creatinine 76 micromol/L, sodium 139 mmol/L, and potassium 3.6 mmol/L. An MRI of the brain conducted the following day showed restricted diffusion in the right striatocapsular region consistent with an acute ischaemic stroke (Figures 1-3), classified as a partial anterior circulation infarct (PACI) on the Oxfordshire Community Stroke Project Classification. Carotid Doppler showed all velocities and waveforms within normal limits and minimal intimal thickening in both common carotid arteries. An ECG showed sinus bradycardia.

Past medical history included type II diabetes mellitus (diet controlled, previously treated with metformin), colorectal cancer (surgical resection with anastomosis 10 years previously), and chronic obstructive pulmonary disease (ex-smoker, 50 pack-year history). Family history was significant for a fatal myocardial infarction in his father, at age 56. Regular medications before admission included tiotropium 18 microgram inhaled daily, fluticasone/salmeterol 250/25 microgram twice daily, dutasteride 0.5 mg /tamsulosin 0.4 mg mane, paracetamol 1 gram three times daily as required and magnesium supplementation 500 mg twice daily.

Physiotherapy and nursing staff reported a decline in function from one week post-stroke. The patient reported fatigue, insomnia, nausea, and restless legs. On examination, he was hypotensive, bradycardic, with an unstable gait, body drift and collapse to the left. Blood biochemistry revealed a sodium level of 127 mmol/L and a potassium level of 4.7 mmol/L. Clinically he was euvolaemic. Sodium chloride 600 mg tablets were commenced, as initially a fluid restriction was not deemed clinically appropriate due to a deficient baseline fluid intake. A repeat MRI brain showed a slight increase in the size of the infarct (Figures 4-6) but no haemorrhagic transformation (Figure 7) to account for the functional decline. Plasma osmolality was 261 mmol/kg and a spot urine osmolality was 722 mmol/kg. A 1.5 L fluid restriction was commenced ten days post stroke. Urinary sodium was not investigated.

Early morning serum cortisol was reduced at 35 nmol/L with an adrenocorticotrophic hormone (ACTH) level of 1.4 pmol/L. Serum sodium continued to decrease to 118 mmol/L despite sodium replacement tablets. Oral cortisone acetate 25 mg BD was commenced as a treatment for hypocortisolism

An ACTH stimulation test (250 microgram) showed a serum cortisol level of 660 nmol/L at 30 minutes, indicating an adequate response. However, interpretation of the test was complicated by the prior commencement of exogenous cortisone therapy. Fluid restriction was ceased. Further investigation found other pituitary hormones to be within normal limits (prolactin 81 mU/L, luteinizing hormone 6.4 U/L, thyroid-stimulating hormone 0.9 mU/L). Aldosterone serum/renin plasma ratio (supine) was 334 pmol/L:26 mU/L.

1 After 25 days of rehabilitation (including physiotherapy, occupational therapy and speech  
2 therapy), there was a significant improvement in left-sided power from Medical Research  
3 Council (MRC) grade of muscle strength 2/5 to 4+/5 with functional independence. The  
4 modified Rankin Scale (mRS) on discharge was 2+. Prior to discharge, there was ongoing  
5 difficulty with fine motor movements in his left hand, for which occupational therapy was to  
6 continue following discharge.  
7  
8 Prior to discharge, serum sodium had returned to 137 mmol/L and potassium to 4 mmol/L.  
9 Following a good response to cortisone acetate, the patient was discharged on a 25 mg/day  
10 until review at two months at which sodium levels had normalised.

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## Discussion

Relative adrenal insufficiency can occur throughout the progression of a severe illness and is generally transient [1]. A study of 58 acute ischaemic stroke patients found the prevalence of relative adrenal insufficiency in such patients is 65.5 % based on a low dose synacthen test (1 microgram), or 31 % based on a standard dose synacthen test (250 microgram) [1]. In our patient, it was difficult to interpret the ACTH stimulation test as exogenous cortisone had been commenced; however, secondary adrenal insufficiency was mechanistically possible from a CNS insult in a patient who was otherwise systemically well. Other anterior pituitary hormones were within normal range.

For patients recently started on steroid replacement, steroid therapy should be withheld on the evening prior to, and morning of, the ACTH stimulation test. In certain clinical scenarios, such as critical illness, changes in cortisol-binding globulin levels can influence post-dose total serum cortisol levels during the ACTH stimulation test. In such situations, other pathology tests (plasma free cortisol, salivary cortisol or free cortisol index) can be ordered to investigate underlying abnormalities in the HPA axis [6]. These tests were unfortunately not utilised in this case.

The underlying mechanism behind relative adrenal insufficiency in stroke has previously been suggested to involve vasospasm resulting in a reduction in the blood supply to the pituitary gland and/or hypothalamus [1]. Another proposed mechanism includes increases in inflammatory cytokines, which inhibit the synthesis of cortisol from the adrenal gland and in turn facilitate resistance to corticosteroids at a tissue-specific level [5].

In regards to rehabilitation, one study investigating stroke patients with upper limb impairment found that 95 % of patients achieved their maximal functional recovery by nine weeks post-stroke, and 80 % by three weeks post-stroke [7]. Improvements in neurological deficits post-stroke in our case were comparable to this timeframe.

Stroke medicine has rapidly advanced in the past decade. For large vessel occlusion causing acute ischaemic strokes, endovascular thrombectomy is considered best practice in selected patients [8]. Further research is ongoing into tissue plasminogen activator time limits, alternatives for thrombolytics and patient selection for endovascular thrombectomy [9]. In this particular case, thrombolysis was not applicable as this patient awoke with symptoms (wake-up stroke) and therefore time of symptom onset is taken from when the patient was last seen well (over six hours). The current time limit for intravenous thrombolysis is four and a half hours and six hours for endovascular clot retrieval; however, recent trials (DEFUSE-3 [10] and DAWN [11]) have shown that selected patients may benefit from thrombectomy up to 16 to 24 hours after symptom onset. For regional and outer metropolitan hospitals offering thrombolysis only, there could be a shift towards the “drip and ship” model with an initiation of thrombolysis and urgent transfer to comprehensive stroke centres [12]. This is already in place in some states, such as Victoria, which offer a statewide service for endovascular clot retrieval in acute ischaemic stroke [13].

## 1   **Conclusion**

2  
3   Our patient made a progressive recovery over 25 days, showing significant improvement in  
4   left-sided power with a mRS score of 2+ at discharge, improving to 4+ at one year follow-up.  
5   Cortisone therapy was ceased after two months, in keeping with the literature stating that if  
6   relative adrenal insufficiency occurs throughout the progression of an illness it is generally  
7   transient [1].

8  
9   This case serves as a reminder to clinicians and medical students of the importance of  
10   monitoring for functional decline and electrolyte imbalances in patients undergoing  
11   rehabilitation post-stroke. The learning points from this case are: to be vigilant in monitoring  
12   expected and unexpected complications post-stroke and to encourage participation in  
13   rehabilitation, especially in patients who do not receive acute therapy. This increases the  
14   likeliness of a return to near baseline function.

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1   **Consent Declaration**

2  
3   Informed consent was obtained from the patient for publication of this case report and  
4   accompanying figures.

5  
6   **Acknowledgments**

7  
8   The author would like to acknowledge Adj. Clin. Prof. J A Millar from Albany Regional  
9   Hospital for his mentorship, and his dedication and enthusiasm for teaching medical students.

10  
11   Also, a special mention to Dr. Paul Salmon (Radiologist, Great Southern Radiology) for his  
12   assistance with the MRI images.

13  
14   **Conflicts of interest**

15  
16   None declared.

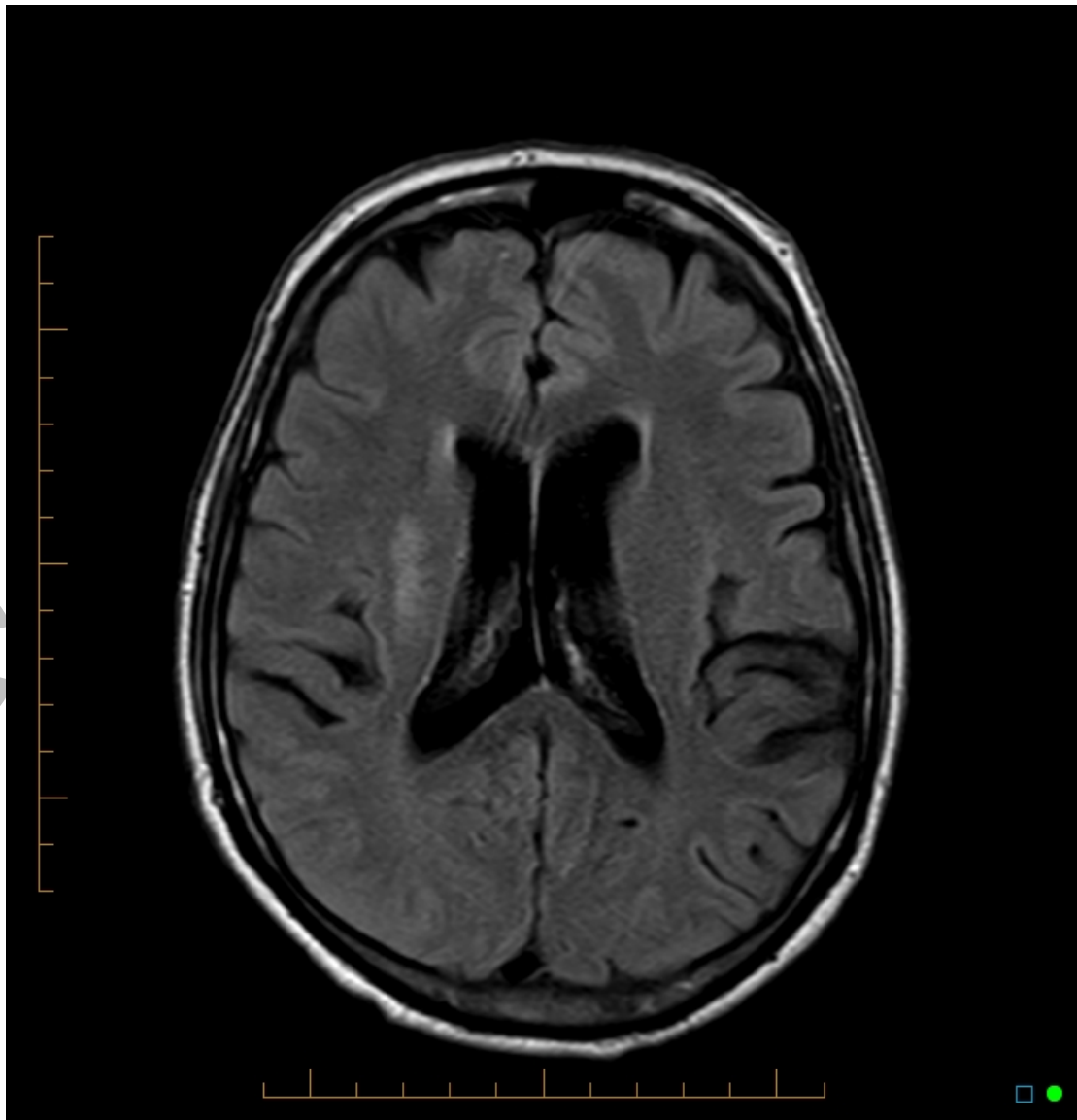
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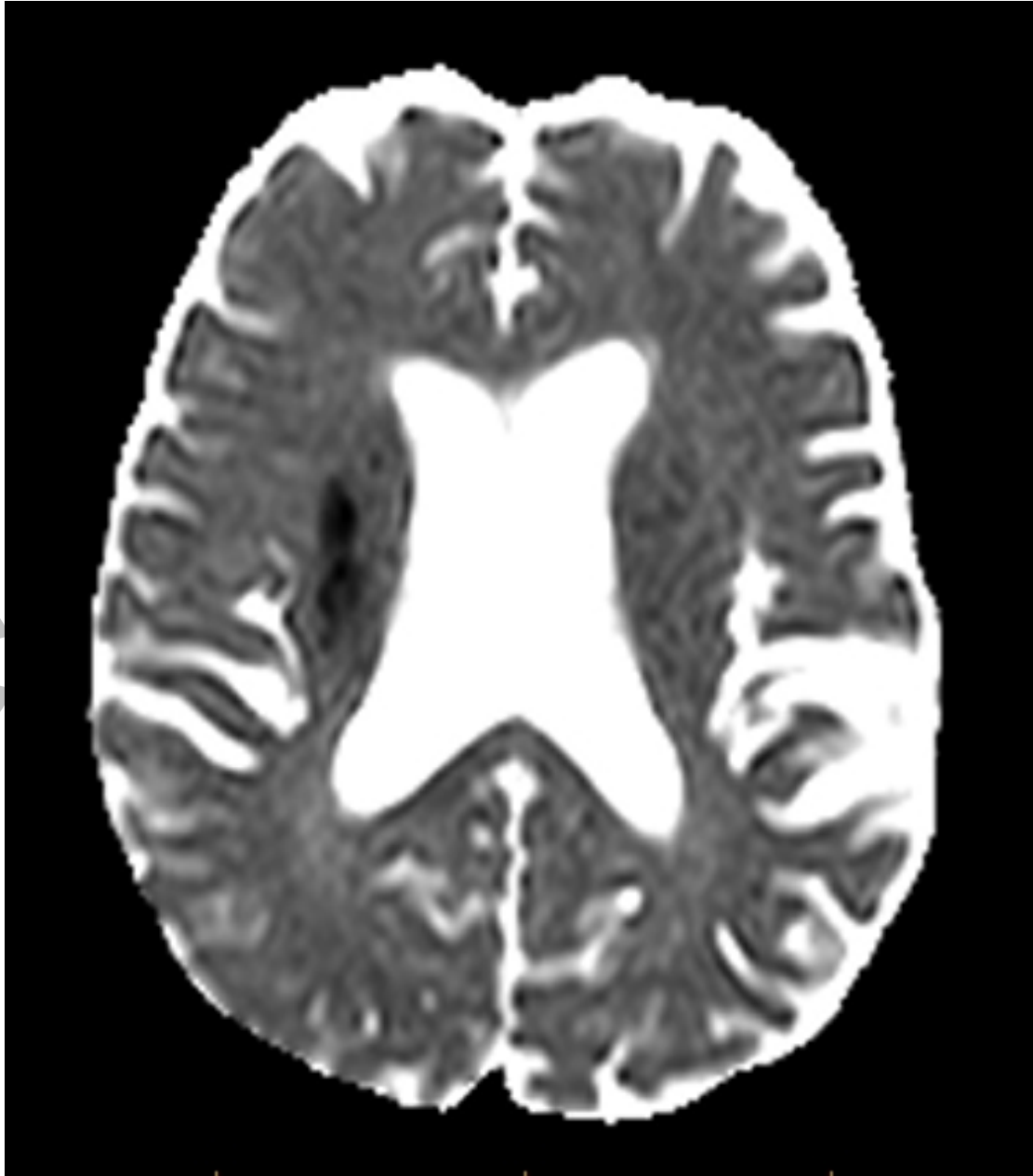
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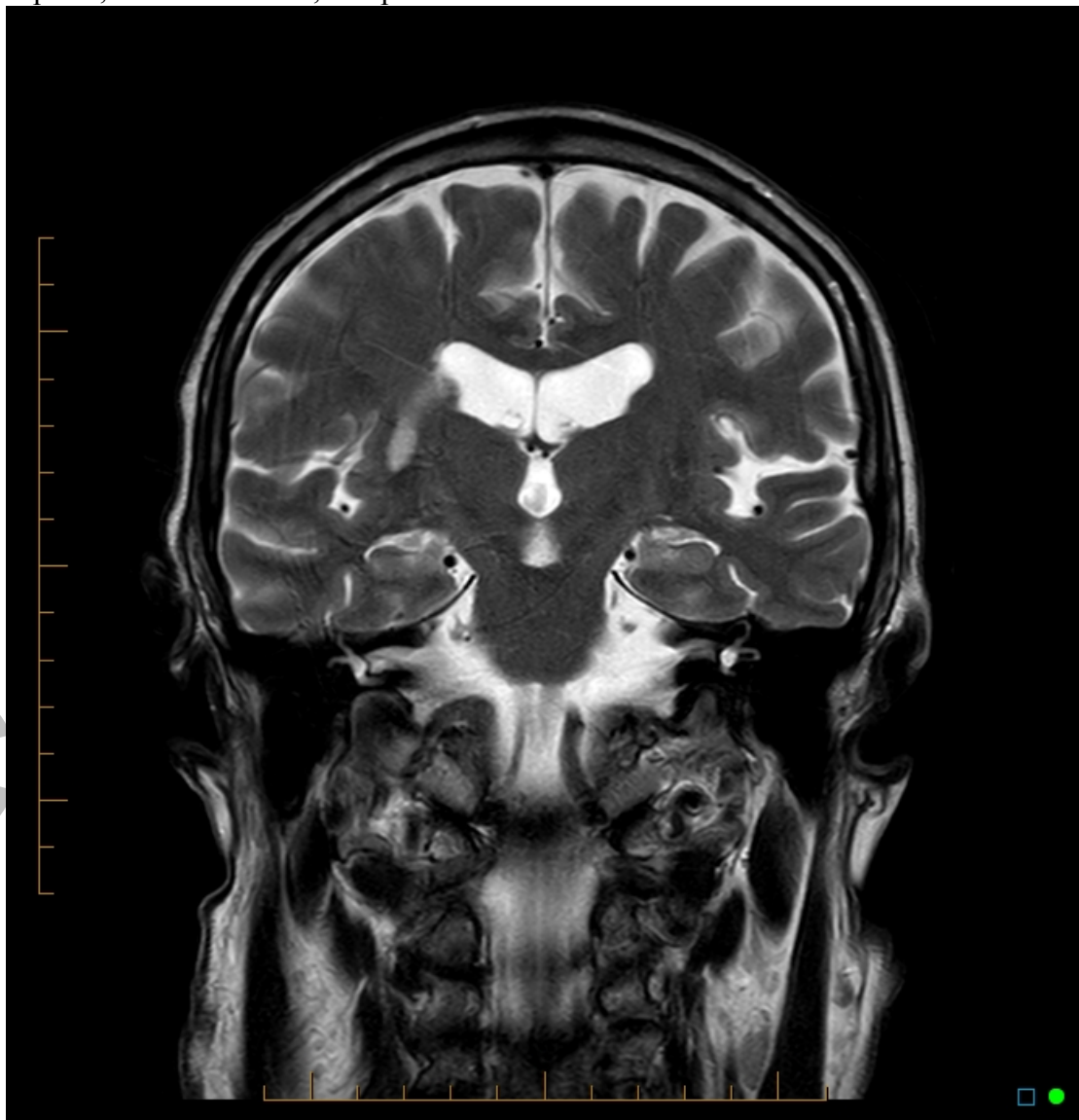
**Figure 1:** Axial fluid-attenuated inversion recovery (FLAIR) MRI image of the brain showing acute right striatocapsular infarction affecting the lateral aspects of the basal ganglia and extending slightly into the periventricular white matter. The FLAIR sequence on MRI adjusts to remove the signal from the cerebrospinal fluid (CSF). This allows for detection of changes close to the CSF (periventricular areas).



**Figure 2:** Diffusion weighted imaging (DWI) through a stereotypic sequence of apparent diffusion coefficient (ADC) reduction MRI image of the brain showing an acute right striatocapsular infarction affecting the lateral aspects of the basal ganglia and extending slightly into the periventricular white matter.



**Figure 3:** MRI image (T2) of the brain showing acute right striatocapsular infarction demonstrated in the coronal plane. Striatocapsular infarcts involve a proximal middle cerebral artery occlusion, affecting areas such as the anterior limb of the internal capsule, caudate nucleus, and putamen.



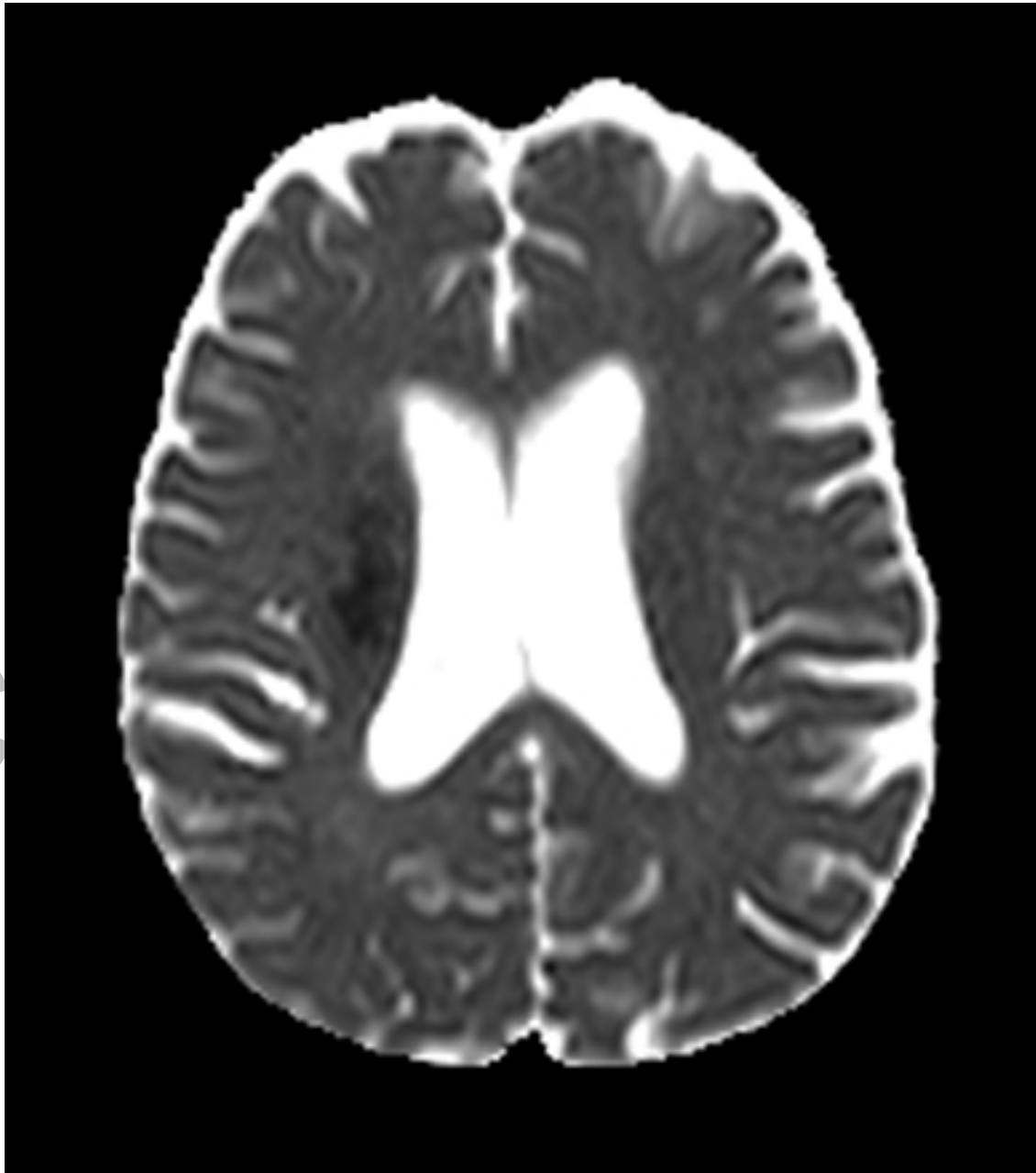
**Figure 4:** Six days post-stroke, axial fluid-attenuated inversion recovery (FLAIR) MRI image of the brain showing a slight increase in size of the known right striatocapsular infarct.



**Figure 5:** Six days post-stroke, MRI image (T2) of the brain showing a slight increase in size of the known right striatocapsular infarct demonstrated in the coronal plane.



**Figure 6:** Six days post-stroke, diffusion weighted imaging (DWI) through a stereotypic sequence of apparent diffusion coefficient (ADC) MRI image of the brain showing a slight increase in size of the known right striatocapsular infarct.





**Figure 7:** Six days post-stroke, susceptibility weighted imaging (SWI) showing no haemorrhagic transformation. SWI is useful for detecting small amounts of haemorrhage and blood products that may not be apparent on other MRI sequences.

