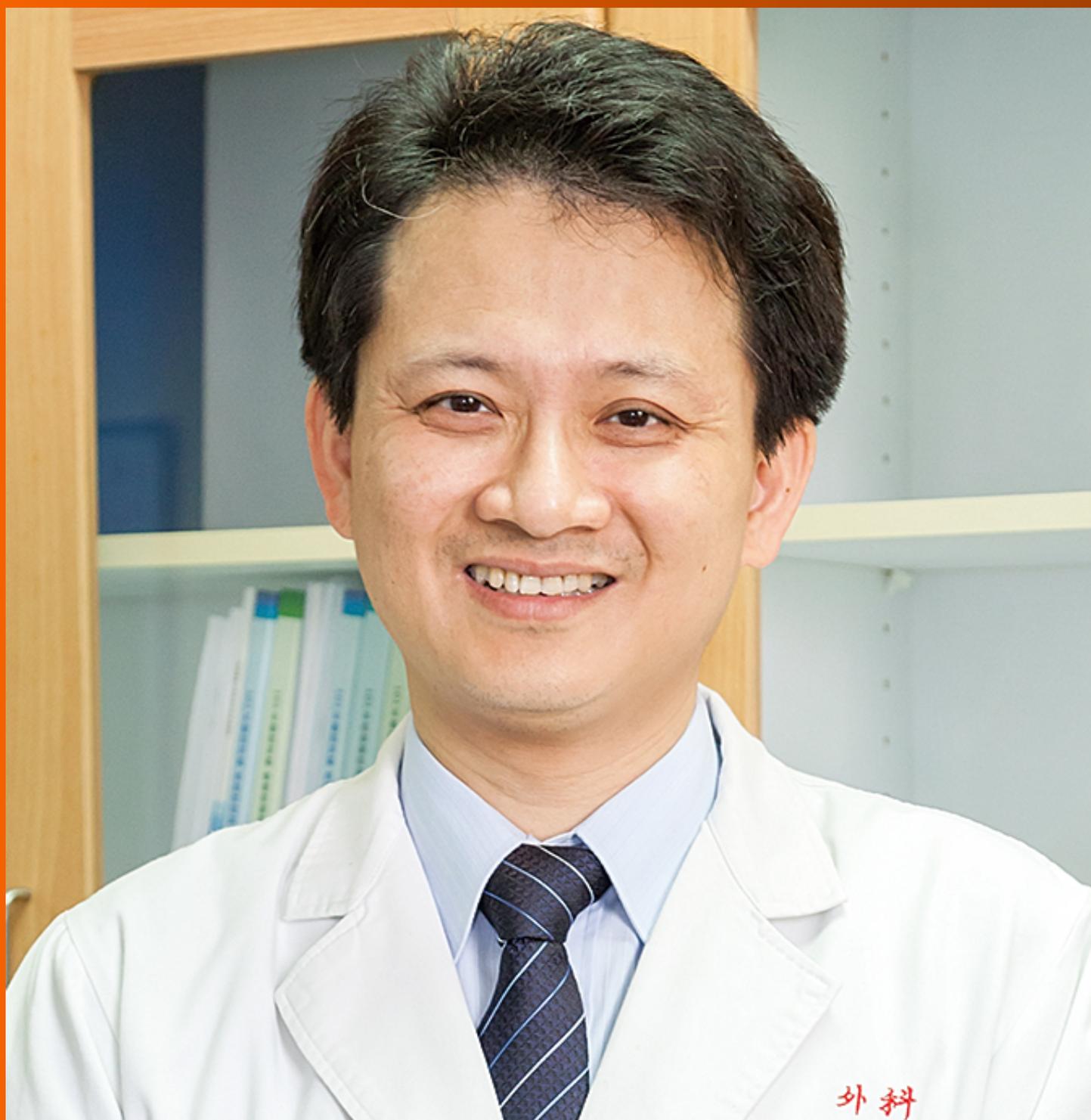


World Journal of *Clinical Cases*

World J Clin Cases 2023 May 16; 11(14): 3114-3368



OPINION REVIEW

- 3114 Modernising autism spectrum disorder model engineering and treatment *via* CRISPR-Cas9: A gene reprogramming approach
Sandhu A, Kumar A, Rawat K, Gautam V, Sharma A, Saha L

REVIEW

- 3128 Burden of disability in type 2 diabetes mellitus and the moderating effects of physical activity
Oyewole OO, Ale AO, Ogunlana MO, Gurayah T

MINIREVIEWS

- 3140 Postoperative hypoxemia for patients undergoing Stanford type A aortic dissection
Liu HY, Zhang SP, Zhang CX, Gao QY, Liu YY, Ge SL

ORIGINAL ARTICLE**Case Control Study**

- 3148 Impact of extended nursing model after multi-disciplinary treatment on young patient with post-stroke
Xu XY, Pang ZJ, Li MH, Wang K, Song J, Cao Y, Fang M
- 3158 Changes and significance of serum ubiquitin carboxyl-terminal hydrolase L1 and glial fibrillary acidic protein in patients with glioma
Zhu QH, Wu JK, Hou GL

Retrospective Study

- 3167 Multitrack and multianchor point screw technique combined with the Wiltse approach for lesion debridement for lumbar tuberculosis
Yuan YF, Ren ZX, Zhang C, Li GJ, Liu BZ, Li XD, Miao J, Li JF
- 3176 Clinical features and prognostic factors in 49 patients with follicular lymphoma at a single center: A retrospective analysis
Wu H, Sun HC, Ouyang GF
- 3187 Value of optical coherence tomography measurement of macular thickness and optic disc parameters for glaucoma screening in patients with high myopia
Mu H, Li RS, Yin Z, Feng ZL

Observational Study

- 3195 Comparative study of the clinical efficacy of all-inside and traditional techniques in anterior cruciate ligament reconstruction
An BJ, Wang YT, Zhao Z, Wang MX, Xing GY

- 3204** Positioning and design by computed tomography imaging in neuroendoscopic surgery of patients with chronic subdural hematoma

Wang XJ, Yin YH, Zhang LY, Wang ZF, Sun C, Cui ZM

- 3211** Evaluation of chronic idiopathic tinnitus and its psychosocial triggers

Hamed SA, Attiah FA, Fawzy M, Azzam M

- 3224** Intestinal complications in patients with Crohn's disease in the Brazilian public healthcare system between 2011 and 2020

Sasaki LY, Martins AL, Galhardi-Gasparini R, Saad-Hossne R, Ritter AMV, Barreto TB, Marcolino T, Balula B, Yang-Santos C

Randomized Controlled Trial

- 3238** Effect of non-pharmacological treatment on the full recovery of social functioning in patients with attention deficit hyperactivity disorder

Lv YB, Cheng W, Wang MH, Wang XM, Hu YL, Lv LQ

CASE REPORT

- 3248** Diagnosis of tuberculous uveitis by the macrogenome of intraocular fluid: A case report and review of the literature

Zhang YK, Guan Y, Zhao J, Wang LF

- 3256** Intra gastric fish bones migrate into the liver: A case report

Dai MG, Zheng JJ, Yang J, Ye B

- 3261** Primary seminal vesicle adenocarcinoma with a history of seminal vesicle cyst: A case report and review of literature

Yao Y, Liu S, He YL, Luo L, Zhang GM

- 3267** Immune checkpoint inhibitor therapy-induced autoimmune polyendocrine syndrome type II and Crohn's disease: A case report

Gao MJ, Xu Y, Wang WB

- 3275** Late-onset mitochondrial encephalomyopathy with lactic acidosis and stroke-like episodes syndrome with mitochondrial DNA 3243A>G mutation masquerading as autoimmune encephalitis: A case report

Wang JW, Yuan XB, Chen HF

- 3282** Metastatic gastric cancer from breast carcinoma presenting with paraneoplastic rheumatic syndrome: A case report

Rech MB, da-Cruz ER, Salgado K, Balbinot RA, Balbinot SS, Soldera J

- 3288** Novel mutation of SPG4 gene in a Chinese family with hereditary spastic paraplegia: A case report

Wang J, Bu WT, Zhu MJ, Tang JY, Liu XM

- 3295** Chronic pulmonary mucormycosis caused by rhizopus microsporus mimics lung carcinoma in an immunocompetent adult: A case report

Guo XZ, Gong LH, Wang WX, Yang DS, Zhang BH, Zhou ZT, Yu XH

- 3304** Idiopathic sclerosing mesenteritis presenting with small bowel volvulus in a patient with antiphospholipid syndrome: A case report
Chennavasin P, Gururatsakul M
- 3311** *Neisseria mucosa* - A rare cause of peritoneal dialysis-related peritonitis: A case report
Ren JM, Zhang XY, Liu SY
- 3317** Rectal prolapse in a 30-year-old bladder stone male patient: A case report
Ding HX, Huang JG, Feng C, Tai SC
- 3323** Successful treatment of veno-arterial extracorporeal membrane oxygenation complicated with left ventricular thrombus by intravenous thrombolysis: A case report
Wang YD, Lin JF, Huang XY, Han XD
- 3330** Successful remimazolam sedation-epidural block in an older patient with severe chronic obstructive pulmonary disease: A case report
Yu JJ, Pei HS, Meng Y
- 3340** *De novo* mutation of *NAXE (APOA1BP)*-related early-onset progressive encephalopathy with brain edema and/or leukoencephalopathy-1: A case report
Ding L, Huang TT, Ying GH, Wang SY, Xu HF, Qian H, Rahman F, Lu XP, Guo H, Zheng G, Zhang G
- 3351** Iatrogenic atlantoaxial rotatory subluxation after thyroidectomy in a pediatric patient: A case report
Hong WJ, Lee JK, Hong JH, Han MS, Lee SS
- 3356** Bladder metastasis from epidermal growth factor receptor mutant lung cancer: A case report
Jin CB, Yang L
- 3362** Primary rectal mucosa-associated lymphoid tissue lymphoma treated with only endoscopic submucosal dissection: A case report
Lee WS, Noh MG, Joo YE

ABOUT COVER

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Late-onset mitochondrial encephalomyopathy with lactic acidosis and stroke-like episodes syndrome with mitochondrial DNA 3243A>G mutation masquerading as autoimmune encephalitis: A case report

Jian-Wei Wang, Xiao-Bo Yuan, Hong-Fang Chen

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Abstract

BACKGROUND

Here, we present a unique case of mitochondrial encephalomyopathy with lactic acidosis and stroke-like episodes (MELAS) syndrome, which initially appeared to be autoimmune encephalitis and was ultimately confirmed as MELAS with the mitochondrial DNA 3243A>G mutation.

CASE SUMMARY

A 58-year-old female presented with acute-onset speech impediment and auditory hallucinations, symmetrical bitemporal lobe abnormalities, clinical and laboratory findings, and a lack of relevant prodromal history, which suggested diagnosis of autoimmune encephalitis. Further work-up, in conjunction with the patient's medical history, family history, and lactate peak on brain lesions on magnetic resonance imaging, suggested a mitochondrial disorder. Mitochondrial genome analysis revealed the m.3243A>G variant in the *MT-TL1* gene, which led to a diagnosis of MELAS syndrome.

CONCLUSION

This case underscores the importance of considering MELAS as a potential cause of autoimmune encephalitis even if patients are over 40 years of age, as the symptoms and signs are atypical for MELAS syndrome.

Key Words: MELAS; Mitochondrial DNA mutation; Encephalitis; Case report

Core Tip: Mitochondrial encephalomyopathy with lactic acidosis and stroke-like episodes (MELAS) syndrome is a multimitochondrial disease caused by DNA mutations and respiratory chain defects that is frequently misdiagnosed. Here, we describe a 58-year-old patient with MELAS syndrome who initially presented with acute cognitive impairment, tinnitus, and headache and was subsequently misdiagnosed with autoimmune encephalitis. The final diagnosis was based on MELAS mutation blood tests and magnetic resonance imaging results. The patient was treated with appropriate medication and gradually improved. This case shows that MELAS syndrome should be diagnosed only after other causes, including autoimmune encephalitis, have been ruled out and the atypical clinical features of MELAS syndrome, such as older age of onset, have been considered.

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INTRODUCTION

Mitochondrial encephalopathy, lactic acidosis, and stroke-like episodes (MELAS) syndrome is a multisystemic mitochondrial disorder[1]. MELAS is caused by mutations in mitochondrial DNA and subsequent respiratory chain deficiency[2]. In most cases, MELAS syndrome is characterized by severe aches, stroke-like episodes, short stature, sensorineural deafness, cognitive decline, and exercise intolerance. Conversely, hypertrophic cardiomyopathy, ataxia, ophthalmoplegia, and diabetes mellitus are rare features of MELAS[3,4]. MELAS syndrome presenting with the features of acute encephalitis is rare and has been described in only a few case reports[5,6]. Among these few cases, nonviral encephalitis is even rarer and may therefore pose a diagnostic challenge. Of note, the above clinical manifestations generally occur before the age of 40[5].

Here, we report the unique case of a 58-year-old female whose condition initially appeared to be autoimmune encephalitis and who was ultimately diagnosed with MELAS syndrome in the presence of the m.3243A>G mutation.

CASE PRESENTATION

Chief complaints

Speech impediment and auditory hallucination, accompanied by tinnitus and headache for 3 d.

History of present illness

A 58-year-old female presented with sudden cognitive dysfunction, auditory hallucinations, nonsensical behavior, inability to communicate normally with others, and complaints of headache and tinnitus. The patient had no fever, seizures, or consciousness disturbance.

History of past illness

The patient had a history of bilateral hearing loss.

Personal and family history

The patient had no history of mental retardation or cognitive decline up to the time of her acute illness. Moreover, the patient denied a family history of neuromuscular disease, encephalitis, or mitochondrial disease.

Physical examination

On admission, the patient's height was 158 cm, and her weight was 45 kg. On physical examination, her body temperature was 36.5 °C and a history of previous infection and fever were denied. Chest auscultation revealed normal respiratory sounds and a normal heart rate with no murmur. The patient's neurological examination, limited by the above symptoms, was otherwise normal.

Laboratory examinations

Routine laboratory studies, including blood glucose, hepatic and renal function, coagulation testing, glycosylated hemoglobin, autoantibodies, autoantibody spectrum associated with anti-cardiolipin antibodies, thyroid function, homocysteine, serum tumor markers, human immunodeficiency virus antibody test and syphilis spirochete hemagglutination test, were all unremarkable. The patient's serum white cell count was $14.38 \times 10^9/L$, and her C-reactive protein level was 7 mg/L. It is worth noting that her arterial blood lactate level was 4.7 mmol/L.

Imaging examinations

Magnetic resonance imaging (MRI) revealed high-intensity lesions in the bitemporal lobe on T2-weighted images (Figure 1A), fluid-attenuated inversion recovery (FLAIR) (Figure 1B) images, and diffusion-weighted images (DWI) (Figure 1C and E). The parts of the lesions involving the cortex appeared hyperintense on DWI (Figure 1C) and hypointense on apparent diffusion coefficient (ADC) maps (Figure 1D), features consistent with cytotoxic edema. Follow-up brain MRI obtained on Day 27 showed an extensive reduction in FLAIR/DWI signals in the left temporal lobe (Figure 1F and G), without an apparent reduction in T2 signals.

Electrophysiological detection

The electroencephalogram only indicated a slight increase in fast waves.

Further diagnostic work-up

Magnetic resonance spectroscopy also revealed a prominent doublet and elevated lactate peak with reduced N-acetyl-aspartate levels (Figure 2). Cerebrospinal fluid (CSF) showed a white cell count of 4/ μ L and a protein level of 0.668 g/L with a CSF pressure of 140 mmH₂O.

FINAL DIAGNOSIS

The mitochondrial DNA (mtDNA) 3243A>G mutation detected in the patient's blood led to the final diagnosis of MELAS syndrome.

TREATMENT

The patient was initially misdiagnosed with autoimmune encephalitis and treated with gamma globulin (18 mg/d \times 5 d) therapy and intravenous methylprednisolone (1000 mg/d \times 3 d to 500 mg/d \times 3 d to 60 mg/d \times 9 d). Then, the patient was discharged with slowly tapered oral methylprednisolone (44 mg/d \times 2 wk followed by a dosage reduction of 4 mg every 2 wk). When the diagnosis of MELAS was confirmed by the presence of the 3243A>G mutation (Figure 3), we immediately stopped intravenous methylprednisolone and started therapy with L-carnitine (oral 1 g/d \times 8 d), L-arginine (oral 4.5 g/d \times 8 d), and coenzyme Q10 (oral 60 mg/d \times 8 d) (Figure 4).

OUTCOME AND FOLLOW-UP

The patient gradually improved before being discharged from the hospital. At the outpatient follow-up a few months later, the patient's cognitive function had recovered well, and she was basically able to take care of herself.

DISCUSSION

Based on some classic features of MELAS syndrome, such as repeated headaches, previous history of hearing impairment, lactic acidosis, peak lactic acid on brain MRI, and the m.3243A>G mutation detected in serum, the diagnosis of MELAS was clear in our case. The clinical presentation of MELAS depends on the existence of heteroplasmy[6], which refers to the ratio of mutant to normal mtDNA, divided into four different transcription stages of 0%, 20%-30%, 50%-90%, and 100%[7]. It is generally believed that the heteroplasmy rate of typical MELAS is 50%-90%, with higher heterogeneity being associated with earlier onset time. The age of MELAS patients is mostly 10-30 years, and there are few reports of MELAS syndrome onset after 40 years of age[1,8-10]. Our patient's late age of onset and some other atypical symptoms were related to the low heteroplasmy.

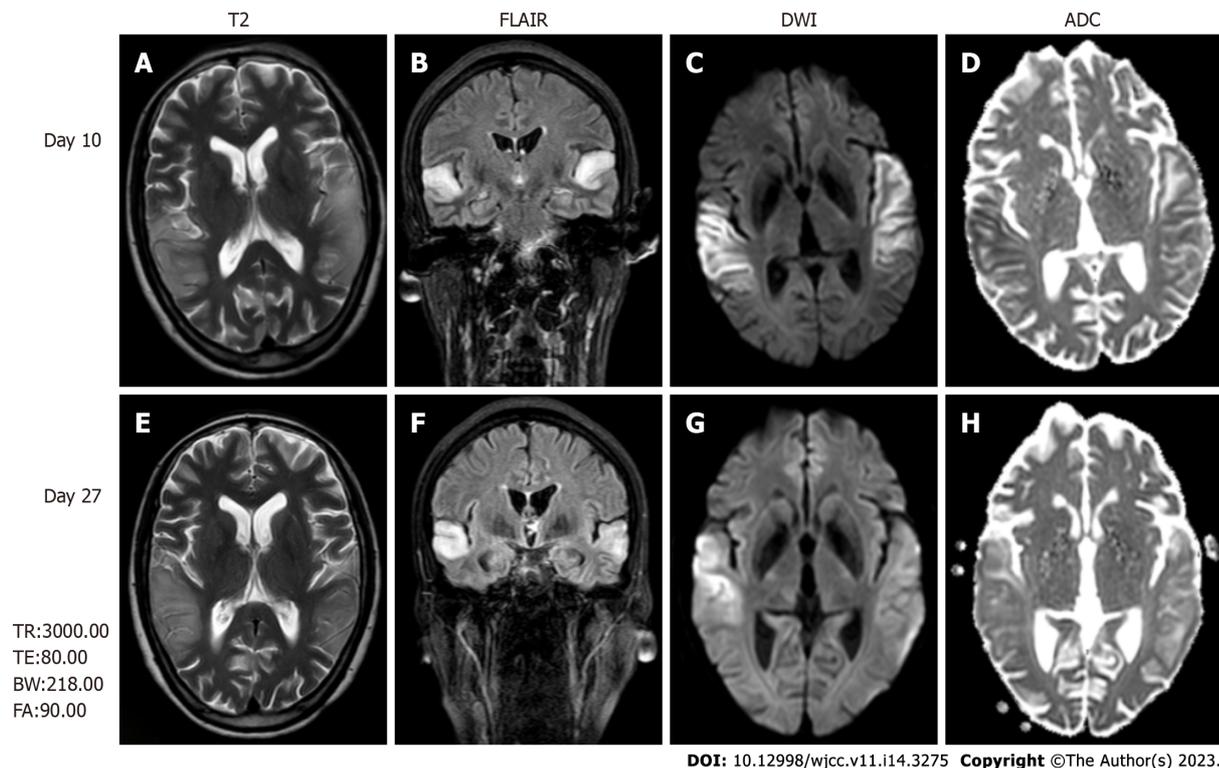


Figure 1 Brain magnetic resonance imaging, fluid-attenuated inversion recovery images, diffusion-weighted images, and apparent diffusion coefficient maps. A and E: Brain magnetic resonance imaging (MRI) revealed high-intensity lesions in the bitemporal lobe on T2-weighted images; B and F: Fluid-attenuated inversion recovery (FLAIR) images; C, D, G and H: Diffusion-weighted images (DWI) (C and G). The parts of the lesions involving the cortex appeared hyperintense on DWI (C and G) and hypointense on apparent diffusion coefficient maps (D and H), which is consistent with cytotoxic edema. The follow-up brain MRI obtained on day 27 showed extensive reduction FLAIR/DWI signals in the left temporal lobe, without an apparent reduction in T2 signals. T2: T2-weighted images; FLAIR: Fluid-attenuated inversion recovery images; DWI: Diffusion-weighted images; ADC: Apparent diffusion coefficient.

This case initially appeared to be autoimmune encephalitis. Few cases of MELAS appearing as acute encephalitis have been reported[11-15]. Most of these cases appear to be herpes simplex encephalitis (HSE). Johns *et al*[11] described three cases with different onset symptoms, all of which involved 3243A>G mutations and increased serum lactic acid levels. The intracranial lesions in all three patients were located in the unilateral temporal or parietal lobes. The case reported by Sharfstein *et al*[12] was characterized by aphasia and delirium; the lesions were located in the left temporal and parietal lobes, and the patient carried the 3243A>G mutation. Hsu *et al*[13] described a patient with acute-onset pyrexia, headache, and seizures who showed aberrant pleocytosis in the CSF but no obvious abnormalities on MRI. The lesions described by both Gieraerts *et al*[14] and Caldarazzo Ienco *et al*[16] were bilateral, but in the study by Gieraerts *et al*[14], the lesions were widely distributed; in the study by Caldarazzo Ienco *et al*[16], they were confined to the bilateral temporal lobes. All of the cases in these abovementioned studies were characterized by the mitochondrial 3243A>G mutation. Of note, 80% of MELAS patients carry the m.3243A>G mutation in the MT-TL1 gene, whereas the frequency of this mutation in the general population is approximately 1:15000[17]. Diseases related to other types of mutations are also misdiagnosed as encephalitis in approximately 20% of MELAS patients. Yokota *et al* [15] described a patient with the mtDNA 14453G→A mutation and acute cognitive impairment, psychosis, headache, and pyrexia who showed mild pleocytosis in the CSF and a lesion in the right temporoparietal lobe.

Based on the above cases, the distribution of lesions in MELAS syndrome patients can be diverse, and the symmetry of MELAS lesions is becoming gradually recognized[18,19]. However, the signal distribution of MELAS lesions on DWI and ADC is relatively unique, especially when compared with ischemic stroke lesions. MELAS lesions most often occur due to vasogenic edema; thus, the signal intensity on ADC maps is not or only mildly reduced[20,21]. In contrast, ischemic areas are primarily caused by cytotoxic edema and generally present as restricted diffusion and low signals on ADC maps [22,23]. This phenomenon is consistent with the imaging in our case.

HSE was not the first diagnosis we considered for our patient. First, the patient's CSF was normal, and the gold standard for diagnosing HSE was not detected. Second, the lesions in the bilateral temporal lobes on brain MRI reduced the likelihood of HSE[24,25], though the negative results for the presence of antibodies against neuronal surface antigens in the CSF could not rule out the possibility of autoimmune encephalitis. Graus *et al*[26] reported clinical diagnostic criteria for autoimmune encephalitis and specifically pointed out that mitochondrial diseases can result in a diagnosis different from

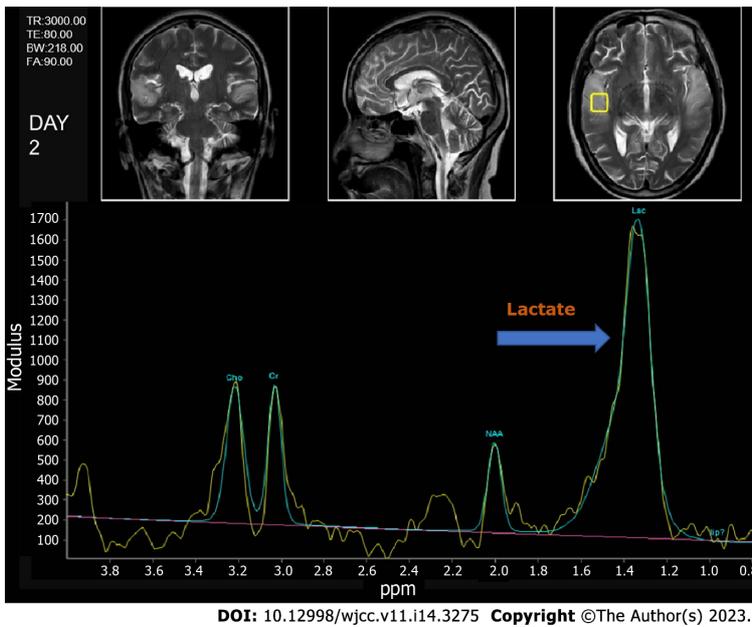


Figure 2 Brain magnetic resonance spectroscopy image, with a visible lip peak in the lesion area, a significantly increased lactate peak, and a decreased NAA peak.

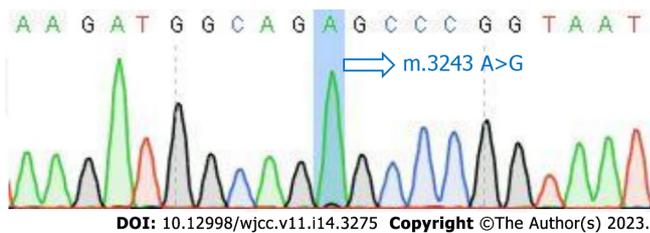


Figure 3 Results of the mitochondrial encephalomyopathy with lactic acidosis and stroke-like episodes mutation blood test.

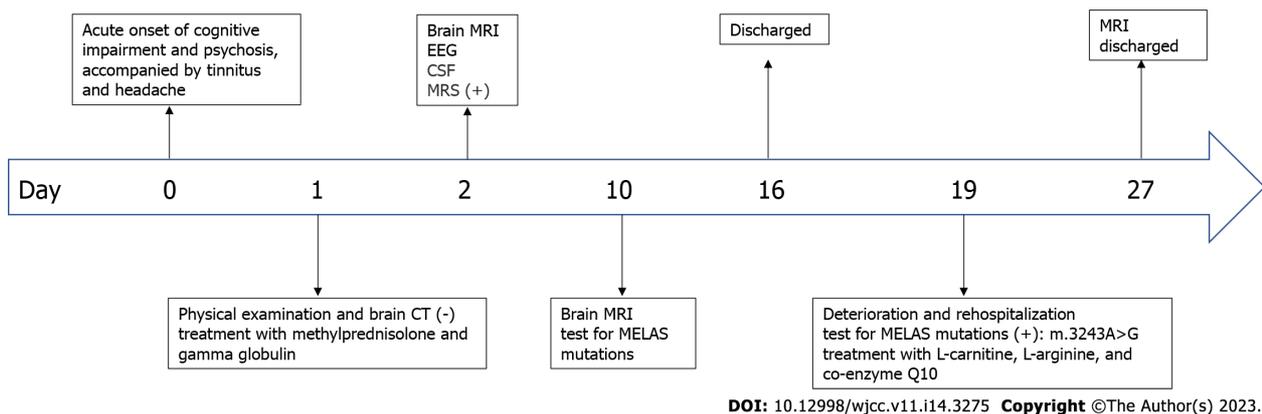


Figure 4 The timeline of the patient's clinical course. CT: Computed tomography; MRI: Magnetic resonance imaging; EEG: Electroencephalogram; CSF: Cerebrospinal fluid; MRS: Magnetic resonance spectroscopy; MELAS: Mitochondrial encephalopathy, lactic acidosis, and stroke-like episodes.

autoimmune encephalitis. When the present patient visited one of our physicians, we accepted the original diagnosis of autoimmune encephalitis and discharged her. When she subsequently developed deteriorated mental status under normal medication, combined with the findings of magnetic resonance spectroscopy and serum lactic acid, we then considered the possibility of metabolic disorders, especially MELAS. The final diagnosis of our patient was confirmed by molecular genetic testing of mitochondrial DNA. This case highlights the importance of deferring a diagnosis of autoimmune encephalitis until alternative causes, including MELAS syndrome, have been excluded, especially in antibody-negative encephalitis. It should be recognized that some atypical clinical symptoms of MELAS, such as onset at

an advanced age, and deviation from the classic brain MRI features, including symmetry of the lesion location, are being increasingly reported. In particular, when a disease cannot be clearly diagnosed, we should decisively turn our attention to patient characteristics that do not conform to “classic” features.

CONCLUSION

This case shows that late-onset MELAS syndrome is rare but should be carefully considered in patients presenting with relevant symptoms as a crucial step in the diagnosis and treatment of such patients.

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FOOTNOTES

Author contributions: Chen HF and Yuan XB played a major role in the acquisition of data; Chen HF and Wang JW analyzed and interpreted the patient data regarding a series of MRI images; Chen HF and Yuan XB were major contributors in writing the manuscript; all authors have read and approved the final manuscript.

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