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Published in:
European Heart Journal - Case Reports

DOI:
10.1093/ehjcr/ytab265

Published: 01/08/2021

Document Version
Publisher's PDF, also known as Version of record

ESC European Society of Cardiology

European Heart Journal - Case Reports (2021) **5**(8), 1–6
doi:10.1093/ehjcr/ytab265

CASE REPORT
Other

Prosthetic valve endocarditis presenting as meningoencephalitis complicated by pseudo-aneurysms in a remote Aboriginal healthcare setting in Australia: a case report

Anna Louise Watson [1]*, Gregory Rice [2], Tony Hieu Vo[1,3] and Nadarajah Kangaharan [1,4,5]

[1]Royal Darwin Hospital, 105 Rockland Drive, Tiwi, Northern Territory 0810, Australia; [2]Flinders Medical Centre, Flinders Drive, Bedford Park, South Australia 5042, Australia; [3]Gold Coast University Hospital, 1 Hospital Blvd, Southport, Queensland 4215, Australia; [4]Menzies School of Health Research, 58 Rocklands Drive, Tiwi, Northern Territory 0810, Australia; and [5]Flinders University, Nightingale Road, Tiwi, Northern Territory 0810, Australia

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Received 21 September 2020; first decision 14 January 2021; accepted 27 April 2021

Background The Australian Aboriginal population has a high burden of cardiac conditions predisposing patients to infective endocarditis. Pseudo-aneurysms are a rare and potentially fatal complication of both prior valvular surgery and endocarditis.

Case summary A 31-year-old female with a history of bicuspid aortic valve requiring valve replacement presented with meningoencephalitis. Transoesophageal echo and positive blood cultures for *Staphylococcus aureus* confirmed prosthetic valve endocarditis (PVE). Aortic root mycotic pseudo-aneurysms developed during antimicrobial therapy and two large pseudo-aneurysms remain post-redo valve, root and arch replacement.

Discussion Complications associated with PVE are common, especially due to *S. aureus*. Redo cardiac surgery is high risk, percutaneous treatments may be technically difficult due to altered post-operative anatomy, and medication adherence issues and lack of healthcare engagement further compromise optimal care in this patient population.

Keywords Bioprosthetic valve • Infective endocarditis • Mycotic aneurysm • Pseudo-aneurysm • Aboriginal • Meningoencephalitis • Case report

Learning points

- The Australian Aboriginal population has a high burden of rheumatic and congenital heart disease, often requiring valvular surgery which all predispose to infective endocarditis.
- Maintain a high suspicion for staphylococcal prosthetic valve endocarditis complications and antimicrobial therapy alone may fail; hence individualised multidisciplinary management plans are essential.
- Pseudo-aneurysms are a potentially fatal complication and can be anatomically challenging to correct.

* Corresponding author. Tel: +61437150785, Email: a_hart89@hotmail.com
Handling Editor: Francesco Giannini
Peer-reviewers: Walid Elmahdy and Andreas Mitsis
Compliance Editor: Hibba Kurdi
Supplementary Material Editor: Nida Ahmed

Introduction

Prosthetic valve endocarditis (PVE) is a serious condition associated with poor outcomes. Aboriginal Australians frequently require valve surgery due to rheumatic heart disease (RHD), infective endocarditis (IE), or congenital heart disease (CHD). The Northern Territory (NT) of Australia has a high prevalence of RHD affecting 2% of the Aboriginal population, who also have a 2.6 times higher risk of CHD than the non-Aboriginal population, with a bicuspid aortic valve (AV) occurring most commonly.[1,2]

We aim to describe a complex case of PVE in a young Aboriginal woman presenting as meningoencephalitis complicated by septic emboli, mycotic aneurysms, and suboptimal adherence with antibiotics, as well as follow-up challenges due to geographic isolation and complex psychosocial dynamics.

Timeline

2003	Diagnosed with congenital bicuspid aortic valve (AV) at age 15.
2016	AV and ascending aortic root replacement with biventricular pacemaker (PPM) inserted at age 27.
2019, Day 0	A 31-year-old female presented with 1 week of headaches, fevers, and confusion.
Day 1	Aeromedical retrieval from remote community to Northern Territory (NT) tertiary hospital. Initially treated as meningoencephalitis.
Day 3	Blood cultures positive for methicillin-resistant *Staphylococcus aureus* and transoesophageal echocardiogram confirming aortic prosthetic valve endocarditis (PVE).
Day 6	Cardiac Case Conference with surgical interstate centre with consensus for medical treatment with a minimum of 6 weeks IV flucloxacillin 2 g Q4H and rifampicin 450 mg PO BD.
Day 15	Craniotomy and drainage of brain abscess culturing *S. aureus*.
Day 42	Baseline positron emission tomography-fluorodeoxyglucose (PET-FDG) consistent with PVE.
Day 45–48	Imaging showing para-valvular and peri-aortic abscess formation and bilateral pseudo-aneurysms.
Day 50	Aeromedical transfer to interstate cardiothoracic surgery facility.
Day 56	Redo-bioprosthetic aortic valve replacement (AVR), aortic root replacement, and PPM and leads explantation. PPM re-inserted 6 days later. Planned for a further 6 weeks IV flucloxacillin and rifampicin post AVR.
Day 74	Returned to NT hospital.
Day 88	Discharged against medical advice and lost to follow-up.
Day 115	Presented to remote community clinic, well, commenced high-dose oral dicloxacillin and rifampicin.
Day 124	PET-FDG with no AVR or extra-cardiac uptake and computed tomography coronary angiogram (CTCA) showing two pseudo-aneurysms stable in size.
Day 194	CTCA showing two pseudo-aneurysms essentially unchanged from previous study.
Day 417	Transthoracic echocardiogram showing normal bioprosthetic valve function.

Case presentation

A 31-year-old Aboriginal female was referred from a remote community in the NT with 1 week of headaches, fevers, confusion, and seizures. She was diagnosed with a bicuspid AV at age 15 with progression to severe stenosis and regurgitation, and development of a 4.7 cm aneurysm of the ascending aorta requiring surgery at age 27. She underwent bioprosthetic aortic valve replacement [AVR, (21 mm St Jude Medical Epic)] and replacement of the ascending aorta with a 20 mm Dacron graft (Maquet Intergard); a dual-chamber pacemaker (PPM) was inserted post-operatively for complete heart block. Concurrent comorbidities included type 2 diabetes mellitus, hypertension, and smoking with suboptimal adherence to metformin, bisoprolol, and aspirin. There was no history of intravenous drug use.

On presentation, she was hypotensive (82 mmHg systolic) with a pulse rate of 80/min, oxygen saturation of 100%, respiratory rate of 22/min, and febrile at 40.1°C with a Glasgow Coma Scale of 14. There were no peripheral stigmata of IE.

She received fluid resuscitation, vasopressor support and broad-spectrum antibiotics prior to aeromedical transfer to a tertiary hospital (with no onsite cardiac surgery) 1000 km away.

Initial pathology demonstrated a normocytic anaemia [haemoglobin (Hb) 113 g/L, mean corpuscular volume (MCV) 83 fL], elevated C-reactive protein (CRP) 320 mg/L and normal white cell count (WCC) 6.7 $\times$ 10^9/L. Lumbar puncture results suggested bacterial meningitis with a neutrophilic pleocytosis; gram stain and cultures were unremarkable. Computed tomography (CT) demonstrated multi-organ septic emboli with cerebral, kidney, and radial artery involvement.

The patient required intensive care unit admission for management of septic shock; antibiotics were subsequently rationalised to IV flucloxacillin 2 g Q4H once *Staphylococcus aureus* was isolated from blood cultures. Combination therapy with gentamicin and rifampicin was avoided given the paucity of evidence supporting better outcomes and concerns for additional toxicity, antimicrobial resistance, and drug interactions.[3] In addition, she received treatment for hyperglycaemia, anaemia (Hb 62 g/L) requiring red blood cell transfusion and diuresis for biventricular heart failure. There was no evidence of bleeding and the normocytic anaemia was attributed to chronic inflammation and subsequent haemodilution.

Electrocardiogram showed sinus rhythm with ventricular pacing and left bundle branch block. Cardiac imaging revealed a small (<0.5 cm)

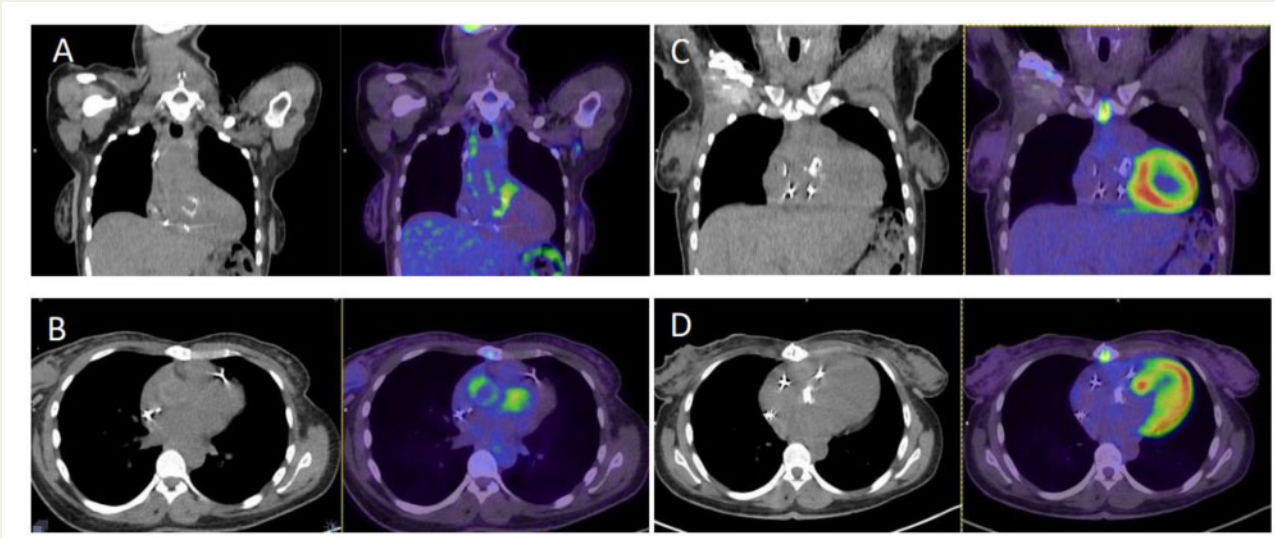

Figure 1 Computed tomography/fluorodeoxyglucose-positron emission tomography images (*A* and *B*) showing abnormal fluorodeoxyglucose uptake in keeping with aortic prosthetic valve endocarditis with mild aortic root graft uptake on day 42, prior to redo-aortic valve replacement. (*C* and *D*) Coronal and sagittal imaging 68 days post-redo aortic valve and root replacement with absent prosthetic material fluorodeoxyglucose uptake confirming eradication of infection.

mobile echodensity on the bioprosthetic AVR consistent with a vegetation without aortic root abscess formation or para-valvular regurgitation. No obvious vegetations were seen on the PPM leads.

On day 6, magnetic resonance imaging brain confirmed multiple cerebral infarcts and associated meningeal enhancement.

The case was discussed at the multi-disciplinary Cardiac Case Conference (CCC) with the supporting interstate cardiac surgical centre with a consensus recommendation for non-surgical management.

On day 13, CT brain showed an evolving left frontal lobe cerebral abscess, requiring neurosurgical intervention with drainage of a 30 × 40 × 20 mm abscess culturing *S. aureus*.

Repeat transthoracic echocardiogram (TTE) was unchanged and the patient remained clinically stable. Rifampicin 450 mg Q12H was added for adjuvant biofilm activity however she discharged against medical advice (DAMA) from the ward on several occasions resulting in interruptions to the IV flucloxacillin and oral rifampicin.

On day 41, a fluorodeoxyglucose-positron emission tomography (FDG-PET) was performed to establish baseline activity prior to completion of antibiotic therapy (*Figure 1*).

On day 45, a follow-up TTE revealed new mild paravalvular aortic incompetence and abnormal Doppler flow external to the aortic root (*Figure 2*). Transoesophageal echocardiogram (TOE) demonstrated formation of two pseudo-aneurysms in the aortic root, one involving the left coronary sinus adjacent to the left main coronary artery (LMCA), and one adjacent to the right coronary cusp above the right coronary artery (*Figure 3*). CT coronary angiogram (CTCA) confirmed para-valvular and peri-aortic abscess formation and bilateral pseudo-aneurysms (*Figure 4*). Repeat blood cultures remained negative. She was urgently transferred to the interstate cardiac surgical centre 3000 km away.

On day 56, she underwent cardiac surgery involving explantation of the previous AV bioprosthesis, aortic graft and PPM, debridement and patch reconstruction of the aortic root with decellularized bovine pericardium, AVR (19 mm Edwards LifeSciences Inspiris Resilia bioprosthesis) and replacement of ascending aorta and hemi-arch. Post-bypass TOE revealed a residual pseudo-aneurysm under the left coronary sinus; as the surgical procedure was already prolonged and complex, this was left alone for consideration of percutaneous interventional closure in the near future. A new dual-chamber PPM was inserted 6 days later.

While initially planned for 6 weeks of post-operative IV flucloxacillin 2 g Q4H and oral rifampicin 450 mg Q12H, antibiotic duration was shortened by 11 days due to DAMA.

She presented to a remote clinic 27 days later and remained clinically well. She was commenced on high-dose oral dicloxacillin and rifampicin until repeat cardiac imaging could be performed. On day 123, an FDG-PET showed no AVR or extra-cardiac uptake (*Figure 1*). CTCA showed two pseudo-aneurysms (*Figure 5*). The findings were discussed at the CCC; consensus was that the pseudo-aneurysms did not have suitable anatomy for percutaneous closure and that further surgery was prohibitively high risk, and serial monitoring was planned. Inflammatory markers were normal and antibiotics were ceased.

The two pseudo-aneurysms have remained stable in size on CTCA at two and four months after surgery and TTE 1-year post-AVR showed normal bioprosthetic valve function. The patient was recommended to have 3- to 6-monthly clinical review with TTE, PPM interrogation and CTCA; unfortunately, she has failed to attend these and follow-up has been inconsistent. Her last specialist review and TTE were in July 2020, and her most recent PPM interrogation was in early 2021. CTCA is overdue and attempts have been made to facilitate this through care coordinators.

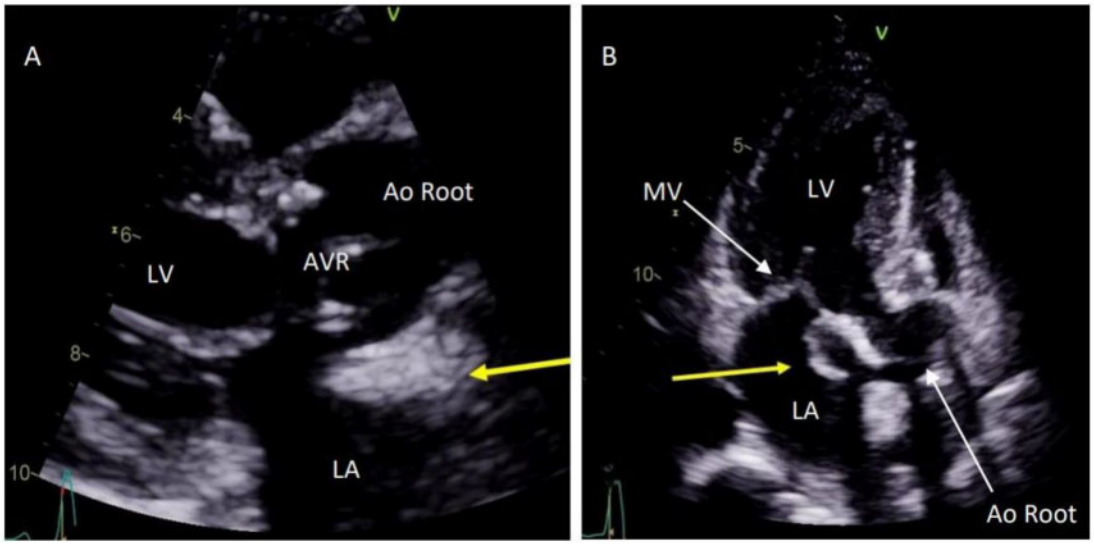

Figure 2 Pre-operative transthoracic echocardiogram of mycotic/pseudo-aneurysm. (*A*) Parasternal long axis. (*B*) Apical three chamber. Yellow arrow pointing to mobile echo density suggestive of mycotic pseudo-aneurysm. Ao Root, aortic root; AVR, aortic valve replacement; LA, left atrium; LV, left ventricle; MV, mitral valve.

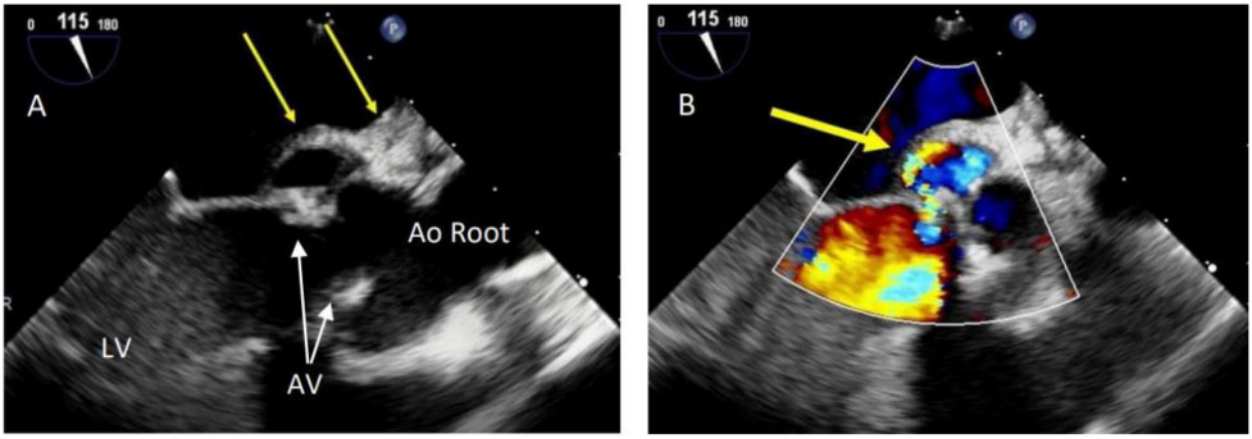

Figure 3 Pre-operative mid-oesophageal long-axis view transoesophageal echocardiogram of the aortic root mycotic/pseudo-aneurysm and abscess (yellow arrows). (*A*) Without colour Doppler showing an aortic root mycotic aneurysm with and abscess. (*B*) With colour Doppler showing flow velocities within the aneurysm. There is also an associated mild paravalvular aortic incompetence. Ao Root, aortic root; AV, aortic valve; LV, left ventricle.

Discussion

Staphylococcus aureus PVE has a mortality rate in excess of 45% and surgical intervention is a class IIa recommendation.[4,5] In this patient, redo surgery was not initially performed given the complexity and risk involved with the procedure, the lack of an absolute indication for intervention and the risk of neurological complication given recent drainage of a brain abscess.

This patient developed both cerebral and mycotic aortic root abscesses despite appropriate antimicrobial therapy illustrating the need to maintain a high suspicion for complications and a low threshold to investigate, especially when prosthetic valves and PPMs are retained. Brief interruptions to antimicrobial therapy due to DAMA may have also contributed to a failure of therapy. Fifty percent of *S. aureus* isolates in NT carry the virulence factor Panton-Valentine leucocidin which is associated with disease in younger patients and

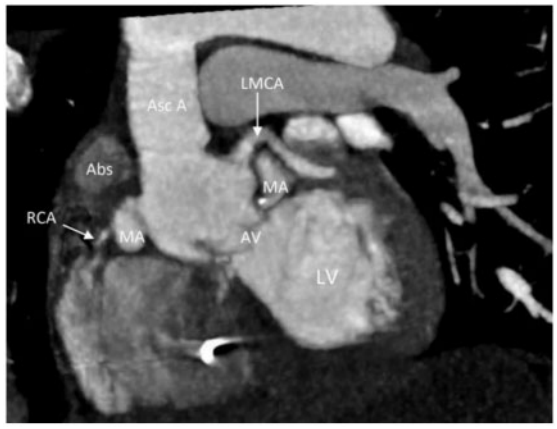

Figure 4 Pre-operative computed tomography coronary angiogram image of mycotic aneurysms and para-aortic abscess. Abnormal aortic appearance with outpouching of both right and left coronary cusps resulting in abnormal cavity consistent with 'mycotic aneurysms'. There is also a para-aortic thickening and extravasation of contrast suggestive of 'para-aortic abscess' formation. Abs, abscess; Asc A, ascending aorta; AV, aortic valve; LMCA, left main coronary artery; LV, left ventricle; MA, mycotic aneurysms; RCA, right coronary artery.

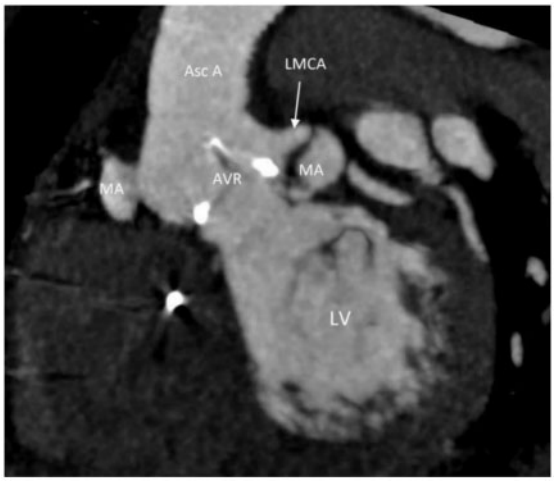

Figure 5 Post-operative computed tomography coronary angiogram image of mycotic aneurysms and redo aortic valve replacement. Outpouching from the right coronary cusp resulting in abnormal cavity consistent with previously 'mycotic or pseudo-aneurysm' measuring maximum length 13 mm and diameter 6 mm. Another pseudo-aneurysm can be seen arising below the aortic valve (left ventricular outflow tract) and outpouching towards the left main coronary artery measuring in length 23 mm, width 15 mm, and narrow neck 3 mm. Asc A, ascending aorta; AVR, aortic valve replacement (bioprosthetic); LMCA, left main coronary artery; LV, left ventricle; MA, mycotic aneurysms.

extensive pyogenic complications, increasing the likelihood of conservative treatment failure.[6]

Pseudo-aneurysms are a complication of PVE and can result in rupture, thromboembolism, compression of nearby structures and infection.[7] The initial pseudo-aneurysms could not be treated percutaneously due to the need to explant all of the adjacent infected prosthetic material. Despite extensive debridement and patch reconstruction of this area, there was a residual pseudo-aneurysm here after surgery, probably due to partial dehiscence of the patch during implantation of the new bioprosthesis, in the context of extreme friability of the infected native tissue. This residual posterior pseudo-aneurysm lies adjacent to the LMCA but has remained stable on serial imaging, as has the other residual pseudo-aneurysm more anteriorly.

It is hoped that these areas are now sterile and may be amenable to future percutaneous treatment. At present this is felt to be not indicated, both on the basis of stable appearance and a degree of unfavourable anatomy for this approach. Options for percutaneous treatment include endovascular coils, occluder devices such as those used for closure of septal defects, and vascular plugs.[8–10] Each of these carries certain technical limitations and risks, and the interventional cardiology advice in this case was that the risk currently outweighed the potential benefit. Surgical repair is also an option but would require explantation of the new aortic bioprosthesis to facilitate closure of the pseudo-aneurysms, and this was also felt to be prohibitively high risk at present.

This young woman's prognosis remains guarded. A third open heart surgery is highly likely given the expected development of bioprosthetic structural valve degeneration.[11] Ideally this would involve implantation of a mechanical prosthesis given her young age and superior valve durability, however life-long warfarin therapy can be challenging in the remote settings due to variety of factors including adherence and access to testing as in this case.[12] If there is rapid expansion of the pseudo-aneurysms prior to this, earlier and possibly emergency intervention may be required.

Lead author biography

Anna Watson is advanced trainee registrar specializing in general medicine and infectious diseases working at the Royal Darwin Hospital located in the Top End of the Northern Territory of Australia. I have a particular interest in Aboriginal health as well as ensure health equity to patients living in remote Australia.

Supplementary material

Supplementary material is available at *European Heart Journal - Case Reports* online.

Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as Supplementary data.

Consent: The authors confirm that written consent for submission and publication of this case report including images and associated text has been obtained from the patient in line with COPE guidance.

Conflict of interest: None declared.

Funding: None declared.

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