Consensus statement for the management of incidentally found brain white matter hyperintensities in general medical practice

Thomas P Ottavi[1], Elizabeth Pepper[1], Grant Bateman[1], Mark Fiorentino[1], Amy Brodtmann[2]

White matter hyperintensities (WMH) of presumed vascular origin are areas of increased signal in the cerebral white matter, best seen on T2 weighted and fluid attenuated inversion recovery (FLAIR) magnetic resonance imaging (MRI) sequences.[1] They are commonly present in about 50% of individuals in their fifth decade[2] and in up to 95% of people by age 90 years.[3] These lesions were considered of little clinical importance, but current evidence suggests that they portend poor brain and cardiovascular health, including increased risk of stroke, cognitive decline and dementia, gait impairments, later life depression, and death.[4-6] Little clinical guidance exists regarding the best management of incidentally found WMH, leaving many health practitioners no option but referral to the neurology outpatient clinic. To address this need, this consensus statement was formed as a guide to investigation and management for general medical practitioners.

Abstract

Introduction: There is a paradigm shift in our understanding of white matter hyperintensities (WMH) found on brain imaging. They were once thought to be a normal phenomenon of ageing and, therefore, warranted no further investigation. However, evidence now suggests these lesions are markers of poor brain and cardiovascular health, portending an increased risk of stroke, cognitive decline, depression and death. Nevertheless, no specific guidelines exist for the management of incidentally found WMH for general medical practitioners and other clinicians ordering brain magnetic resonance imaging scans for diverse clinical indications. Informed by a literature review and expert opinion gleaned from stroke neurologists, medical and imaging specialists, and general practitioners, we present our consensus statement to guide the management of incidentally found WMH in adults.

Main recommendations: When incidental WMH are found on brain imaging:

- Perform a detailed history and examination to screen for neurological events.
- Investigate for potential undiagnosed or undertreated cardiovascular risk factors, especially hypertension and diabetes mellitus.
- Commence intensive and individualised cardiovascular risk management when risk factors are uncovered.
- Treat underlying risk factors via accepted guidelines but note that antiplatelet and anticoagulant medications should not be prescribed for incidental WMH in the absence of an alternative indication.

Changes to management as a result of this consensus statement: A brain health opportunity. We consider the discovery of incidental WMH on brain imaging to represent an opportunity to investigate for common cardiovascular risk factors and to optimise brain health. This can be commenced and monitored by the general practitioner or physician without delay in waiting for an outpatient neurology review.

Pathophysiology of WMH

The pathophysiology of WMH is heterogenous and incompletely understood. Radiologically, these white matter lesions indicate increased water content. Potential aetiologies include demyelination, inflammation, trauma, neoplasm, degeneration, infarction and ischaemia. WMH of presumed vascular origin are thought to be due to chronic ischaemia via age-related degeneration of perforating arterioles, lipohyalinosis, and blood–brain barrier dysfunction.[7]

Radiological appearance

WMH are areas of MRI T2 hyperintense signal in the cerebral white matter. They are generally bilateral and symmetrical,[1] and have many names, including leukoaraiosis and white matter lesions.[1] WMH may be visible on computed tomography imaging of the brain as low density (hypoattenuation) white matter lesions.[8] Radiologists have expertise in the differentiation of WMH of presumed vascular origin from other aetiologies. Their report will benefit from relevant clinical information.

Medical practitioners should be guided by the expert radiology report if a specific diagnosis is raised. However, in patients aged 50 years and older, most white matter lesions are not assigned a specific syndrome.[1]

Although WMH rating scales are rarely used in clinical practice, for research purposes, WMH severity is often graded with the Fazekas score.[9] Higher Fazekas scores and more confluent WMH have been associated with worse cognitive, clinical and functional outcomes.[4] Periventricular WMH, confluent with the lateral ventricles or within 10 mm of the lateral ventricle border,[10] have been associated with poorer cognitive performance than deep WMH, although this is not consistent across all studies (Box 1).[11]

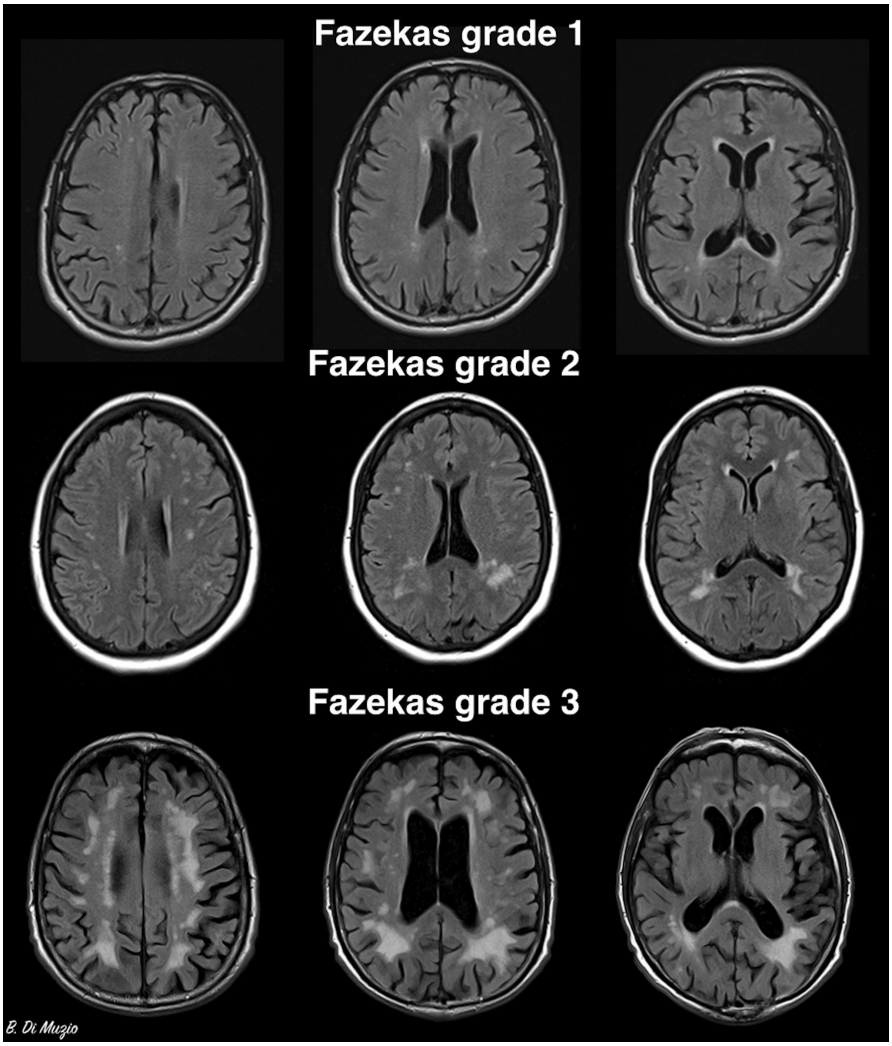
Risk factors

Recognised risk factors for WMH are cardiovascular risk factors, especially age and hypertension.[12] Modifiable risk factors also include smoking[13] and obstructive sleep apnoea.[14,15] The discovery of WMH presents an opportunity for investigation and management of such factors, potentially improving both brain and general health.

We note that WMH are found commonly in migraineurs,[16] but without cardiovascular risk factors they do not confer the same risk as in patients with risk factors.[17] People with epilepsy also have greater WMH burden and this is posited as a contributor to their increased risk of stroke.[18] Several monogenic cerebral small-vessel diseases are associated with characteristic WMH patterns, but discussion and recommendations for these conditions are not included in this statement.[19]

[1]John Hunter Hospital, Newcastle, NSW. [2]Monash University, Melbourne, VIC. thomas.ottavi@health.nsw.gov.au • doi: 10.5694/mja2.52079

1 Magnetic resonance imaging scans representing Fazekas grades*



* The Fazekas grading system divides white matter hyperintensities into deep and periventricular lesions, and grades each region separately: **deep**: 0 = absent, 1 = punctate foci, 2 = early confluence, 3 = large areas of confluence; **periventricular**: 0 = absent, 1 = thin lining or "caps" on lateral ventricles, 2 = smooth halo around lateral ventricles, 3 = irregular periventricular signal extending to the deep white matter.[9] The top row of the figure demonstrates punctate foci and caps on the lateral ventricles; the middle row demonstrates early confluence and smooth halo around lateral ventricles; and the bottom row demonstrates large areas of confluence in the deep white matter and irregular periventricular signal extending to the deep white matter. Source: Image reproduced from Di Muzio B. Fazekas scale for white matter lesions. Case study. Radiopaedia.org doi: 10.53347/rID-36927. https://creativecommons.org/licenses/by-nc-sa/3.0/legalcode (viewed July 2023). ◆

Methods

The aim of this consensus statement is to help clinicians to implement appropriate investigation and management for adults with incidental WMH and improve detection of cardiovascular risk factors and avoid potentially harmful therapies. The need for neurology-driven guidance on the management of incidentally found WMH was identified at the 2021 Australasian Stroke Academy Conference. A writing group consisting of a specialist cognitive neurologist, general neurologist and basic physician trainee was formed. The writing group agreed that the population of interest would be adults (≥ 18 years old) with incidental WMH, with a focus on screening, primary and secondary prevention of stroke and cardiovascular disease via pharmacological and lifestyle interventions, and primary and secondary prevention of dementia risk factors. Comparators were either best medical care or placebo, and the outcomes would be the reduction of risk of stroke, cognitive decline, or dementia.

Given the anticipated paucity of primary studies on this topic, this consensus statement was developed through a literature review and expert opinion. The Appraisal of Guidelines for Research and Evaluation (AGREE) II instrument[20] was used to guide development, and the quality of evidence for key recommendations was evaluated using the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) framework (Box 2).[21]

Search strategy

One author (TO) conducted a search of PubMed for all time periods until 20 November 2022. The search terms used were "white matter hyperintensities", "leukoaraiosis", "white matter lesions" and "leukoencephalopathy", plus each relevant risk factor or potential intervention. Priority was given to systematic reviews and meta-analyses of either randomised controlled trials (RCTs) or observational studies and to individual observational studies or RCTs if systematic reviews and meta-analyses were not found. Publications were limited to English.

Expert recommendations

A modified Delphi approach[22] was adopted and an expert panel assembled to inform recommendations in this consensus statement. The panel comprised 14 Australian and New Zealand neurologists with at least three years consultant experience in vascular and/or cognitive neurology. Eight questions regarding investigation and management of incidentally found WMH were answered with either yes or no. A summary of the expert panel's opinion is presented in Box 3 and the questions are provided in the Supporting Information.

External review

To ensure applicability and practicality, we consulted clinicians in relevant specialties. For example, neuroradiologists contributed to writing and editing relevant sections, and expert general physicians, geriatricians, psychiatrists, general practitioners, and general and neurologists also reviewed this consensus statement before publication. Comments from these clinicians were incorporated into the final manuscript. The Australasian Stroke Academy endorses this consensus statement.

Recommendations

Antihypertensive therapy

Antihypertensive therapy is an effective intervention to reduce the risk of cardiovascular events and is an important risk factor for presence and progression of WMH.[13] A meta-analysis found that antihypertensive medication had a modest effect on WMH

2 Summary of recommendations, quality of evidence, and expert opinion for interventions for incidental white matter hyperintensities (WMH)

Intervention	Recommendation	Quality of evidence (GRADE) for intervention	Expert opinion
Blood pressure control	Blood pressure should be treated to a target of 120/80 mmHg through lifestyle and pharmacological interventions to reduce WMH progression	⨁◯◯◯ Very low	Majority (79%) support cardiovascular risk management but most (57%) do not recommend a blood pressure target below 120/80 mmHg
LDL cholesterol-lowering medication	Statins should not be commenced for incidentally found WMH unless in the presence of hypercholesterolaemia	⨁◯◯◯ Very low	Insufficient evidence to support prescription of statins for incidental WMH
Multidomain lifestyle intervention	Individuals should be encouraged to increase fitness and lose weight if overweight or obese, especially in the presence of type 2 diabetes mellitus, but prescription of an exercise program is not necessary	⨁◯◯◯ Very low	Majority (64%) do not support a prescription of an exercise program
Smoking cessation	Individuals should be given support to quit smoking	⨁◯◯◯ Very low	-
Aspirin	Aspirin should not be commenced in the presence of WMH in the absence of another indication	⨁◯◯◯ Very low	Majority (86%) recommend against aspirin use in the absence of another indication
Anticoagulation	Anticoagulation should not be commenced for the treatment of WMH in the absence of another indication	⨁◯◯◯ Very low	No evidence to support anticoagulation for incidental WMH in the absence of an established indication

GRADE = Grading of Recommendations, Assessment, Development and Evaluation; LDL = low-density lipoprotein. ◆

progression (standardised mean difference [SMD], −0.19; 95% confidence interval [CI], −0.32 to −0.06).[23] One RCT included in this meta-analysis suggested that WMH volume reduction did not protect against or reverse cognitive decline.[24] There is a small literature regarding stroke survivors wherein intensive antihypertensive treatment was associated with Fazekas score-graded WMH reduction and reduced stroke recurrence, especially in patients with the greatest blood pressure reduction.[25]

Another meta-analysis reported a similar effect of antihypertensive therapy on WMH (SMD, −0.22; 95%CI, −0.36 to −0.07).[26] To investigate optimal blood pressure targets, the meta-analysis authors performed a subgroup analysis, stratifying by blood pressure at follow-up, and found the effect of antihypertensive medication on WMH volume remained significant only if a systolic blood pressure of 110–129 mmHg was achieved.[26] We note that the Canadian Consensus Conference on Diagnosis and Treatment of Dementia recommends targeting a systolic blood pressure of less than 120 mmHg in middle-aged individuals with vascular risk factors, positing this may confer modest protection against developing mild cognitive impairment.[27] The SPRINT-MIND trial, an RCT investigating systolic blood pressure targets of 140 mmHg versus 120 mmHg on the risk of probable dementia, found no difference in incidence of probable dementia between the two groups,[28] but the study may not have been adequately powered to detect a difference.

In summary, the association between hypertension and WMH is the most well studied of all risk factors. Evidence from meta-analyses supports a beneficial effect of blood pressure reduction on WMH burden. The clinical benefit on cognition of reducing WMH volume is yet to be fully determined (Box 4).

3 Summary of recommendations and expert opinion for investigations for incidental white matter hyperintensities (WMH)

Recommendation	Expert opinion
Screening should include investigation of lipids, HbA_{1c} level, blood pressure, smoking status, and ECG	Majority (93%) support cardiovascular risk screening
Screening for OSA	Majority (64%) do not support screening for OSA
24-Hour ambulatory blood pressure monitoring	Majority (71%) do not support 24-hour ambulatory blood pressure monitoring
Screening for cognitive impairment	Majority (64%) do not support formal screening for cognitive impairment

ECG = electrocardiogram; HbA_{1c} = glycated haemoglobin; OSA = obstructive sleep apnoea. ◆

Statins

A systematic review and meta-analysis of RCTs investigating statin therapy and risk of covert infarcts found that patients randomly assigned to statin treatment had a lower risk of new covert infarcts (relative risk, 0.63; 95% CI, 0.46–0.88; $P = 0.006$).[29] However, heterogenous participants were recruited[30-32] and different statins were used. Of these studies, only one RCT of older Chinese people with carotid atherosclerotic disease[33] using both sartans and statins reported a change in WMH volume in a subgroup analysis. Patients assigned to rosuvastatin 10 mg daily had a significantly lower increase in WMH volume after an average follow-up time of 61.8 months.[30] A secondary outcome from this trial was incidence of mild cognitive impairment, defined by a score of 23 or below or a decline by three points or less on the Mini-Mental State Examination (MMSE) or a score of 123 or less on the dementia rating scale at any follow-up visit.[33] The telmisartan versus placebo arm showed no difference in incidence of mild cognitive impairment, but the rosuvastatin

4 Summary of evidence for antihypertensive therapy on white matter hyperintensities (WMH) accumulation and neurological disease risk

Intervention: Antihypertensives

Effect on WMH: Modest effect for reducing progression

Effect on cognition: Possible modest effect if systolic blood pressure is < 120 mmHg

Effect on stroke risk: Possible reduction in stroke risk

Recommendations:

- Blood pressure should be controlled to a target of 120/80 mmHg through pharmacological and lifestyle interventions to reduce WMH progression
  - GRADE quality of evidence: very low
  - Expert opinion: majority (79%) in favour
- A blood pressure target < 120/80 mmHg should not be sought
  - GRADE quality of evidence: very low
  - Expert opinion: majority (57%) against lower blood pressure target
- 24-Hour ambulatory blood pressure monitoring is not required
  - GRADE: not assessable
  - Expert opinion: majority (71%) do not recommend 24-hour ambulatory blood pressure monitoring

Advice to patients: WMH may represent damage to the brain from uncontrolled blood pressure. Lowering blood pressure will lead to a reduced risk of progression of WMH and reduce the risk of strokes and heart attacks

GRADE = Grading of Recommendations, Assessment, Development and Evaluation. ◆

5 Summary of evidence for statin therapy on white matter hyperintensities (WMH) accumulation and neurological disease risk

Intervention: Statins

Effect on WMH: May reduce accumulation

Effect on cognition: Not adequately studied in patients with incidental WMH

Effect on stroke risk: May reduce risk if strong cardiovascular disease risk factors are present

Recommendation: Statins should not be commenced for incidentally found WMH

- GRADE quality of evidence: very low
- Expert opinion: not sought due to absence of evidence of benefit

Advice to patients: Although high cholesterol may be contributing to WMH burden, there is not enough evidence to support commencing medications without another indication. Healthy lifestyle changes are still advisable

GRADE = Grading of Recommendations, Assessment, Development and Evaluation. ◆

versus placebo arm revealed a decrease in mild cognitive impairment (hazard ratio, 0.54; 95% CI, 0.36-0.80).[33]

Montreal Cognitive Assessment (MoCA) scores increased from an average of 18 to 22 in the rosuvastatin plus nimodipine group and from 17 to 19 in the control group after six months of treatment in another RCT of mild cognitive impairment in patients with cerebral small vessel disease ($P < 0.05$).[34] Although this may support statin treatment in patients with mild cognitive impairment, it cannot be extrapolated to those in whom WMH are purely incidental.

In summary, direct evidence is lacking for statin treatment for incidentally found WMH. The above studies were conducted in populations that were older, had established cardiovascular disease or mild cognitive impairment, and combined statins with antihypertensives, making untangling the effect of statins alone difficult. Therefore, no specific recommendation for statin treatment is made in this consensus statement, other than to follow existing lipid-lowering guidelines (Box 5).

Anticoagulants and antiplatelet medications

Aspirin

Aspirin is proven therapy for secondary prevention of stroke. The ASPREE study conclusively demonstrated that aspirin was not indicated for primary prevention of stroke owing to a greater risk of adverse effects, including intracerebral haemorrhage.[35] There is no evidence for the role of aspirin in the treatment of incidental WMH. Canadian-based guidelines for the management of vascular cognitive impairment recommend aspirin in patients with stroke and mild cognitive impairment or dementia and WMH, but not for those with no history of stroke.[27]

In summary, the increased risk of harm from aspirin use for primary prevention has been established in the ASPREE study.[35] Although primary treatment of WMH with aspirin has not been systematically examined, international guidelines do not support aspirin use in patients with WMH and mild cognitive impairment or dementia without demonstrated stroke (Box 6).

Anticoagulants

The COMPASS study randomly assigned patients with stable coronary or peripheral artery disease to aspirin 100 mg daily, rivaroxaban 5 mg twice daily or aspirin 100 mg daily plus rivaroxaban 2.5 mg twice daily, and demonstrated a reduced incidence of strokes in the rivaroxaban plus aspirin group.[36] No difference in the rate of WMH accrual was observed between patients receiving aspirin plus rivaroxaban versus rivaroxaban alone versus aspirin alone in an associated substudy.[37] However, due to early termination, the study was not powered to exclude a clinically important difference and allow conclusions about the effect of rivaroxaban on WMH accrual (Box 7).

Diet and exercise interventions

Metabolic syndrome — defined as central adiposity, triglycerides greater than 1.7 mmol/L, high-density lipoprotein cholesterol less than 1.0 mmol/L in men and less than 1.3 mmol/L in women, systolic blood pressure greater than 130 mmHg and/or diastolic blood pressure greater than 85 mmHg, and fasting blood glucose greater than 5.5 mmol/L[38] — is a known risk factor for stroke and cardiovascular disease.[39] Cross-sectional studies have supported an association between metabolic syndrome and WMH progression[39,40] but this is less clear in prospective studies.

6 Summary of evidence for antiplatelet therapy (aspirin) on white matter hyperintensities (WMH) accumulation and neurological disease risk

Intervention: Aspirin

Effect on WMH: Unknown

Effect on cognition: None

Effect on stroke risk: Decreased only when used for secondary prevention

Recommendation: Aspirin should not be commenced in the presence of WMH in the absence of another indication

- GRADE quality of evidence: very low
- Expert opinion: majority (86%) do not support prescription of aspirin in the absence of another indication

Advice to patients: The risk of bleeding due to aspirin will outweigh the benefit of this medication if used purely for treatment of incidental WMH

GRADE = Grading of Recommendations, Assessment, Development and Evaluation. ◆

7 Summary of evidence for anticoagulation therapy on white matter hyperintensities (WMH) accumulation and neurological disease risk

Intervention: Low dose anticoagulation

Effect on WMH: Unknown

Effect on cognition: Unknown

Effect on stroke risk: Evidence of reduced risk of stroke in people with stable peripheral or coronary artery disease for combination of low dose rivaroxaban and aspirin compared with aspirin alone, but rivaroxaban monotherapy did not reduce ischaemic stroke and increased risk of haemorrhagic stroke[36]

Recommendation: Anticoagulation should not be commenced for the treatment of WMH in the absence of another indication

- GRADE quality of evidence: very low
- Expert opinion: not sought due to absence of evidence of benefit

Advice to patients: The risk of bleeding due to anticoagulation will outweigh the benefit of this medication if used purely for treatment of incidental WMH

GRADE = Grading of Recommendations, Assessment, Development and Evaluation. ◆

8 Summary of evidence for lifestyle intervention on white matter hyperintensities (WMH) accumulation and neurological disease risk

Intervention: Diet, exercise, and smoking cessation

Effect on WMH: May reduce progression

Effect on cognition: Further studies required

Effect on stroke risk: Reduces risk

Recommendations:

- Screening should include investigation of lipids, HbA_{1c} level, blood pressure, smoking status, and ECG
  - GRADE quality of evidence: not assessable
  - Expert opinion: majority (93%) support cardiovascular risk screening
- Individuals should be encouraged to increase fitness and lose weight if overweight or obese, especially in the presence of type 2 diabetes mellitus
  - GRADE quality of evidence: very low
  - Expert opinion: majority (79%) support cardiovascular risk factor management
- Formal prescription of an exercise program is not necessary for patients with incidentally found WMH
  - GRADE quality of evidence: very low
  - Expert opinion: majority (64%) do not support prescription of an exercise program
- Individuals with incidentally found WMH who smoke should be given support to quit smoking
  - GRADE quality of evidence: very low
  - Expert opinion: majority (79%) support cardiovascular risk factor management

Advice to patients: Achieving the recommended level of exercise, eating a healthy diet and quitting smoking (if applicable) may reduce WMH progression and will protect against cardiovascular disease

ECG = electrocardiogram; HbA_{1c} = glycated haemoglobin; GRADE = Grading of Recommendations, Assessment, Development and Evaluation. ◆

An analysis of participants of the Mayo Clinic Study of Aging who had completed at least two MRI brain scans found that age, hypertension (especially in women), and impaired fasting glucose (especially in men) were all independently associated with WMH progression, but metabolic syndrome was not a significant independent risk factor.[12] However, when individuals with type 2 diabetes were randomly assigned to an intensive diet and exercise intervention or support and education arms, the intensive intervention group had significantly smaller WMH volumes at follow-up ten to 12 years later.[41] There was no evidence that this protected against cognitive decline. However, in a three-year observational study of cognitively normal adults with WMH, those with a greater level of physical activity were less likely to progress to cognitive decline or dementia.[42] There is some evidence that resistance training for cognitively normal women aged 65–75 years was associated with lower WMH volumes and better maintenance of gait speed, but no difference in executive function, compared with those in a balance and tone exercise arm of the study.[43] Prevention of stroke was not an outcome assessed in these studies but there is good evidence for lifestyle intervention in reducing risk of stroke and is reflected in guidelines.[44-46]

In summary, prospective studies have demonstrated that a reduction in WMH accrual is possible with the treatment of metabolic syndrome;[41,43] however, it is yet to be determined whether this benefits cognition. We recommend following existing guidelines for diet and exercise[45,46] for optimal cardiovascular and brain health (Box 8).

9 Summary of evidence for obstructive sleep apnoea (OSA) intervention on white matter hyperintensities (WMH) accumulation and neurological disease risk

Intervention: Treatment of OSA

Effect on WMH: Unknown; possible benefit if moderate or severe OSA

Effect on cognition: Unknown

Effect on stroke risk: May reduce risk if good adherence to continuous positive airway pressure

Recommendations: Patients with WMH may not require specific screening for OSA

- GRADE quality of evidence: not assessable
- Expert opinion: majority (64% do not support screening for OSA)

Advice to patients: OSA may be contributing to the presence of WMH. An additional benefit of treating OSA may be reduction in progression of WMH

GRADE = Grading of Recommendations, Assessment, Development and Evaluation. ◆

Smoking cessation

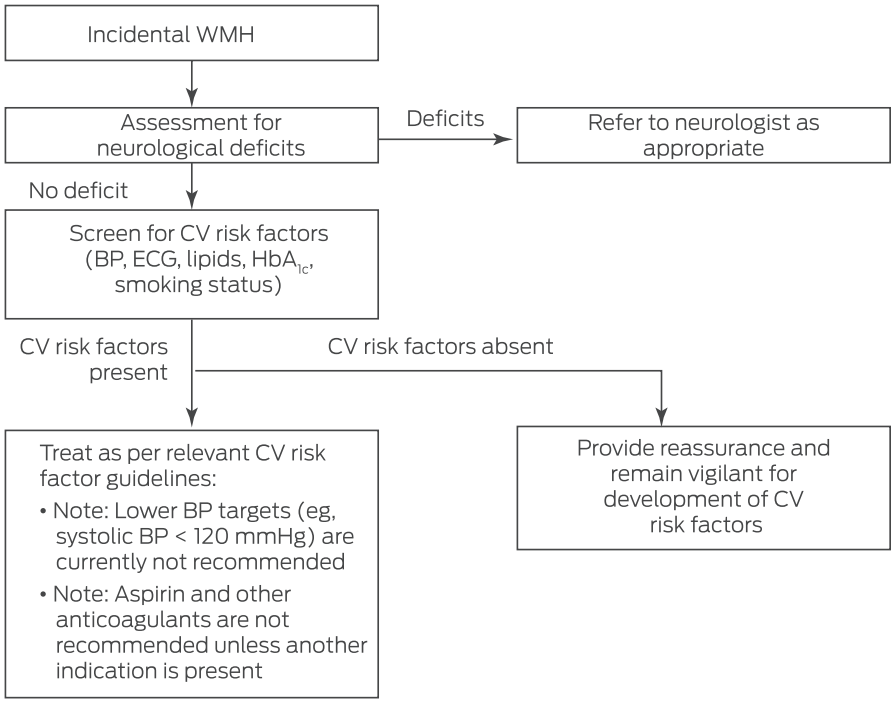
There is a strong association between smoking and WMH.[12,13] In addition to being a vascular risk factor, there is evidence that smoking directly interferes with white matter integrity.[47] A prospective cohort study of almost 1000 individuals who completed MRI brain scans ten years apart found a dose–response relationship between smoking and WMH.[48] There are no specific recommendations for smoking cessation in subclinical cerebrovascular disease.[49] The specific clinical benefit of reducing smoking for WMH is not established, but given the benefits for brain health, smoking cessation is recommended in people with incidental WMH.

In summary, smoking has been shown to be associated with increased WMH; however, the effects on cognition and stroke risk were not examined.[48] Nevertheless, smoking cessation is a routine general preventive health measure (Box 8).

Obstructive sleep apnoea

The association between obstructive sleep apnoea (OSA) and adverse cardiovascular events including stroke is strong,[50] but the association with WMH is less clear. Cross-sectional studies have revealed correlations between moderate to severe OSA[51] and OSA in older patients[52] with WMH prevalence. A meta-analysis of nine cross-sectional and cohort studies comparing the incidence of WMH in individuals with and without OSA found an odds ratio for WMH incidence of 2.31 (95% CI, 1.46–3.66) compared with those without OSA.[14] Another systematic review and meta-analysis found that moderate to severe OSA, but not mild OSA, was significantly associated with WMH incidence.[53] There is variable evidence that adherence to continuous positive airway pressure for treatment of OSA may reduce risk of stroke.[54]

10 Flow chart for clinical assessment and management of patients with incidentally found white matter hyperintensities (WMH)



BP = blood pressure; CV = cardiovascular; ECG = electrocardiogram; HbA_{1c} = glycated haemoglobin. ◆

In summary, evidence for an association between OSA and WMH accrual is provided by two systematic reviews and meta-analyses,[14,52] but the effect of OSA treatment on WMH reduction or prevention of progression is not yet determined. The evidence supports a dose–response relationship, so determining the effect of preventing progression of OSA on WMH accrual would be beneficial (Box 9).

When to refer

Patients with incidentally found WMH are commonly referred to outpatient neurology clinics. This may be driven by concern regarding neurological symptoms, or the radiological differential diagnosis of WMH. In general, a neurology referral is warranted when symptoms and signs are rapidly progressive or unexplained, or when radiological features are atypical for WMH of presumed vascular origin as outlined above (Box 10).

Conclusions

Incidentally found WMH on neuroimaging may be considered an opportunity to screen for and address cardiovascular risk factors to prevent progression to cognitive or other neurological impairment. With the help of this consensus statement, such management can be implemented by general practitioners and non-neurologist physicians. Neurology referral may only be necessary for rapidly progressive or atypical symptoms and atypical radiological findings.

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Supporting Information

Additional Supporting Information is included with the online version of this article.