Assessing the performance of the four question abbreviated mental test in the acute geriatric setting

T Locke, S Keat, M Tate, A Bown, R Ghosh & A Hart

Abstract

Background: *Cognitive impairment is common amongst acute geriatric hospital admissions but detection is often poor and this is associated with worse outcomes. The four-question abbreviated mental test (AMT4) has previously been promoted nationally in the acute setting as a succinct assessment tool. However, a recent national dementia Commissioning for Quality and Innovation (CQUIN) goal recommends a single screening question followed by the ten-question abbreviated mental test (AMT10). We aimed to evaluate the negative predictive value of the AMT4 within the acute setting by comparing it to three other validated tools.*

Methods: *We identified 100 acute medical admissions (>60 years old) with a negative AMT4 and administered the AMT10, six-item cognitive impairment test (6CIT) and confusion assessment method (CAM) within 24 hours of admission.*

Results: *Forty-six percent of the participants scored positively on at least one of the additional tests despite a negative AMT4. Forty-four patients had a positive 6CIT, 23 had a positive AMT10 and six had a positive CAM. Using the 6CIT as a diagnostic standard, tests of short-term memory had the greatest sensitivity and specificity for cognitive impairment.*

Conclusions: *Nearly half of the participants had signs of cognitive impairment despite a negative AMT4. Consequently, there is a risk of under diagnosis with potentially serious consequences for morbidity and mortality. Tests of short-term memory were strongly associated with cognitive impairment. We propose the addition of such a test in order to increase the sensitivity of the AMT4 without compromising its brevity and utility in the acute setting.*

Keywords

Cognitive impairment, Abbreviated mental test score

Key Points

- Cognitive impairment is common in acute geriatric populations and associated with poorer outcomes.
- Prompt recognition of cognitive impairment enables tailored multi-component management plans to be instigated, often with improved outcomes.
- The AMT4 has previously been promoted nationally as a rapid cognitive assessment tool suitable for use in the acute setting. However, more recent guidance recommends a single screening question as an initial screening tool, followed by the AMT10 if necessary.[1]
- Nearly half of the participants admitted to an acute medical ward had signs of cognitive impairment despite a negative AMT4.
- The AMT4 should no longer be used as a screening tool for cognitive impairment on hospital admission; however, addition of a question for short term memory may increase its sensitivity without compromising its brevity.

Background

Cognitive impairment is broadly defined as an impairment of memory associated with learning difficulties and poor concentration;[2] delirium and dementia are common causes in hospital.[3,4] Delirium is characterised by clouding of consciousness, psychomot or disturbance and disruption of the sleep-wake cycle that tends to follow a fluctuating course.[2] Comparatively, dementia follows a chronic and progressive course without abnormalities of consciousness.[2]

Numerous studies have demonstrated a high prevalence of these conditions amongst acute medical admissions, particularly amongst older people.[3,4] Delirium is estimated to develop in 11 - 42% of patients during their hospital stay.[5] In one cohort admitted for emergency medical care, over 40% had

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dementia but only half had been diagnosed prior to admission.[6] Detection of these conditions is often poor with a wide range of adverse consequences including nosocomial complications, prolonged admission, increased mortality, subsequent dementia diagnosis and a greater likelihood of post-discharge institutionalisation.[6-10]

Early identification of cognitive impairment enables tailored multi-component management plans to be instigated, often with improved outcomes.[9,11] Multiple cognitive assessment tools are available, including the Mini Mental State Examination (MMSE), ten-question abbreviated mental test (AMT10), four-question abbreviated mental test (AMT4), six-item cognitive impairment test (6CIT) and the confusion assessment method (CAM).

The AMT4 has previously been promoted nationally by the Department of Health as a screening tool suitable for the acute setting.[12] This test uses 4 questions (place, age, date of birth and year), with a score of less than four being indicative of impaired cognition. More recently, a national dementia Commissioning for Quality and Innovation (CQUIN) goal has been introduced for 2012/13 which recommends a single screening question: *'Has the person been more forgetful in the past 12 months, to the extent that it has significantly affected their daily life?'.*[1] If the answer is yes, then further assessment with the AMT10 is recommended. If the answer is no, then usual care (i.e. no assessment or investigation for possible dementia) is recommended. Screening must be performed on all emergency admissions aged over 75 years and within 48 hours of admission.

The aim of this article is to assess a brief screening tool for dementia and/or delirium by studying the negative predicitive value of the AMT4 for the detection of cognitive impairment in the acute setting, and also to determine whether it can be improved by incorporating additional questions while still maintaining its brevity. The authors compared the performance of the AMT4 with other nationally recommended, validated screening tools.

Method

The project was registered with the local NHS trust clinical effectiveness department. Ethical approval was deemed unnecessary as the tests are already in widespread use.

A group of four junior doctors was recruited for data collection. One hundred participants (over two weeks) were recruited from the medical admission wards using the inclusion criteria below. This sample size was chosen to provide a sufficient yet manageable population given time constraints.

1. Sixty years old or older.
2. Admission within 24 hours.
3. Documented AMT4 score of 4/4 (part of the medical clerking proforma).
4. Medically well enough to be interviewed.

Each participant completed the AMT10, 6CIT (Table 1) and CAM. A proforma was used to minimise variation and included the assessment tools as quoted in the original research papers (except for the AMT10 where year of Second World War was used instead of the First World War in order to be more culturally relevant).[13-15] In this article the term 'positive test' is used to refer to a result that suggests cognitive impairment. This is a score of less than eight for the AMT10 and equal to or greater than eight for the 6CIT. The CAM is less well defined and in order to reduce subjectivity we defined a number of clinical features to act as proxy markers. Specifically, acute cognitive deterioration was demonstrated by reviewing medical notes and covering GP letters and seeking input from family, carers or nursing staff. Inattention and disorganised thinking were assessed throughout the consultation and also using questions from the 6CIT (months of year backwards and month/year respectively). Finally, conscious level was evaluated clinically. A positive CAM was defined as a combination of acute cognitive deterioration and inattention, along with either disorganised thinking, altered conscious level or both.

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Results

A total of 100 participants were recruited, 51 were female. Median age was 79 years old (range 60 to 98).

Forty-six percent (n=46) of the candidates had a positive score on at least one of the additional

Table 1. Six item cognitive impairment test.

Question	Maximum Error	Score X Weight	Weighted Score (Maximum)
1. What year is it?	1	... x 4	(4)
2. What month is it?	1	... x 3	(3)
Repeat then remember the following address: John/Brown/42/West Street/Bedford			
3. What time is it (within one hour)?	1	... x 3	(3)
4. Count backwards from 20 to 1.	2	... x 2	(4)
5. Months of the year backward.	2	... x 2	(4)
6. Repeat address.	5	... x 2	(10)
Total (out of 28)			

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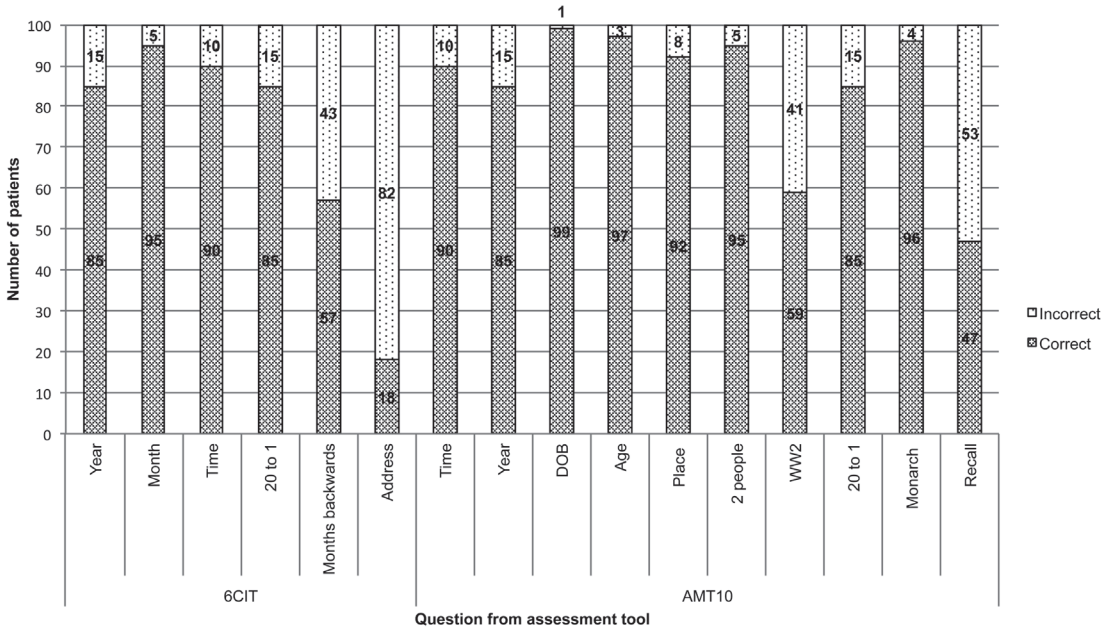


Figure 1. Results to questions from AMT10 and 6CIT.

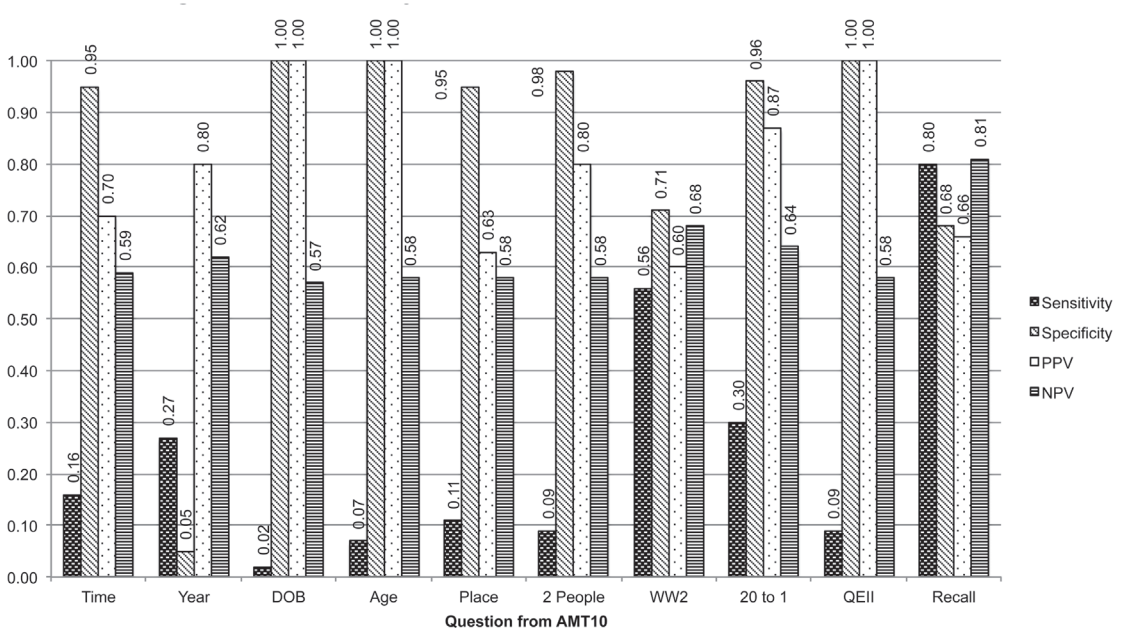


Figure 2. Sensitivity, specificity and predictive values for each question of the AMT10.

cognitive tests. Nineteen failed two tests, most commonly the 6CIT and AMT10.

Forty-four candidates had a positive 6CIT, with a median score of 6/28. Questions frequently answered incorrectly were 'memory recall' (at least one error 82.0%) and 'months backwards' (at least one error 43.0%). The majority of candidates correctly answered the '20 to 1' question (85.0% correct) and the tests of long-term memory (Figure 1).

In the AMT10, 23 (23.0%) had a positive score, with a median score of 9/10. 'Memory recall' and 'dates of World War II' were the most frequent incorrectly answered questions (53.0% and 41.0% respectively) (Figure 1).

Six candidates had a positive CAM test. The most frequently noted abnormality was inattention (44.0%). Disorganised thinking was observed in 17 cases (17.0%), acute deterioration in cognitive function in 11 cases (11.0%) and altered level of consciousness in two cases (2.0%).

Using the 6CIT as a diagnostic standard to evaluate the AMT10 reveals that 'memory recall' has

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the greatest sensitivity and specificity for cognitive impairment (0.80 and 0.68 respectively). This is followed by 'dates of World War II' (sensitivity 0.56 and specificity 0.71) and '20 to 1' (sensitivity 0.30 and specificity 0.96). The majority of the remaining questions had a very low sensitivity with a high specificity (Figure 2).

Discussion

The AMT4 tool evolved from the AMT10 in response to concerns regarding poor uptake and incorrect use of the latter test.[16-18] The brief nature of the test has meant that it has previously been promoted nationally for use in the acute hospital.[12] It was validated by Swain *et al* whom reported a strong association between the AMT4, AMT10 and MMSE in a group of 276 hospitalised patients (aged 60 years and above).[19] However, the AMT4 and linked MMSE were performed at a later unspecified time, "when the patient was medically stable and free of acute illness".[19] Accordingly, the AMT4 may be more valuable in predicting a final diagnosis of dementia when the patient has been stabilised. Additionally, the AMT4 is weighted towards long term memory testing and this faculty is often preserved in mild cognitive impairment. We found only one paper that evaluated the AMT4 in the acute setting and this reports a strong association with both the AMT10 and MMSE amongst a cohort of older people.[20]

Our data demonstrate that in the acute geriatric setting nearly half of the participants with a negative AMT4 were subsequently found to score positively for cognitive impairment using other tests. This may lead to under diagnosis with potentially serious consequences for morbidity and mortality. In particular, this may act as an obstruction to patients accessing specialist care pathways that have been demonstrated to improve outcomes. These findings are at odds with Schofield *et al* and highlight a need for further development of this tool.[20]

The authors felt that the CAM was the most subjective test and was also highly time consuming as it necessitated gathering data from multiple sources. It has also been promoted nationally for use in hospitals, however validation studies noted poor sensitivities when non-physicians or those without specific training administered the test.[21,22] In our experience, it is common for patients to be clerked by junior doctors who are not likely to have the benefit of this experience. This may limit the reliability of the CAM test in clinical practice.

The AMT4 does have the advantage of being succinct and therefore more likely to be utilised in busy acute medical wards. It may therefore be pragmatic to aim to improve the AMT4 by the addition of further questions from the 6CIT or AMT10. Both demonstrate a strong correlation with the MMSE but the 6CIT may be more accurate and concise and was therefore chosen as the diagnostic standard.[23-25] The MMSE was not used in this role as it can be time consuming and may be better suited to rating the severity of disease. Using this methodology, 'dates of World War II' and 'memory recall' were shown to have the greatest sensitivity and specificity for detecting cognitive impairment. Regarding the former, the current iteration of the AMT4 already involves an assessment of long-term memory. Furthermore, the authors suspect that incorrect answers here may be more reflective of educational level rather than cognition – a previously documented concern.[26] 'Memory recall' assesses features of both delirium and dementia; its addition may improve the negative predictive value of the AMT4 without compromising its brevity. We propose an AMT5: a rapid cognitive assessment tool that is suitable for screening elderly populations in the acute setting. Further validation studies are now required.

All tests were administered simultaneously within 24 hours of admission. We do acknowledge the possibility of cognitive impairment developing or fluctuating in the interim between the AMT4 and subsequent tests. However, this time period was chosen for pragmatic reasons and was felt to be short enough to minimise this potential source of inaccuracy. Furthermore, it was much shorter than the original validation of the AMT4.[19]

Conclusion

It is now a national requirement that elderly patients acutely admitted to hospital are screened for cognitive impairment. All national recommendations suggest a brief screening tool, followed by more detailed assessment and referral to specialist services if necessary. A validated screening tool with good sensitivity and specificity yet brief enough to remain feasible for busy acute medical units is required. This study has demonstrated that, in the acute setting, the AMT4 tool fails to identify a significant proportion of patients with cognitive impairment. Adding a question for short-term memory improves the sensitivity to 80% without compromising brevity and utility in the acute setting. Further evaluation of an 'AMT5'may now be warranted.

Declaration of competing interests: Nothing to declare.

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