Is serum creatine kinase:aspartate aminotransferase ratio useful for diagnosing acute myocardial infarction in elderly patients?

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Abstract

Aim: To evaluate the usefulness of the serum creatine kinase: aspartate aminotransferase (CK:AST) ratio in differentiating between myocardial and non-myocardial increases in serum creatine kinase activity in the elderly.

Methods: A three month prospective study of all patients admitted to an acute geriatric unit who were clinically assessed and investigated with electrocardiograms and measurement of CK, AST, and lactate dehydrogenase (LDH) activities on the first three days of admission. Excluding those with liver disease and alcohol misuse, patients with increased CK activity were then classified into four groups depending on whether they had fallen or had an acute myocardial infarction (AMI), or both.

Results: 270 patients were evaluated. CK activity was raised in 86 (31%) patients on any of the first three days of admission. Of these, 31 had fallen, 19 had an AMI, and five had both fallen and sustained an AMI. The CK:AST ratio, on all days, was higher ($p < 0.05$) in those who had fallen. On the second and third days, the CK:AST ratio was higher ($p < 0.01$) in those patients who did not have an AMI. The overlap, however, between these groups was large.

Conclusions: These results did not allow discrimination to be made between myocardial and skeletal sources for increased CK activity. The CK:AST ratio is, therefore, of limited use when applied to the diagnosis of AMI in elderly patients. Clinical evaluation rather than the pattern of enzyme change is more likely to determine the cause of increased CK activity.

(J Clin Pathol 1993;46:264-266)

Acute myocardial infarction (AMI) is a common cause for hospital admission to acute geriatric units. The diagnosis of AMI is difficult in the elderly because they often present with non-specific clinical features or may be unable to give an accurate history because of confusion, dementia, or dysphasia.^{1,2} Consequently AMI may be diagnosed on the basis of raised cardiac enzyme activities.

In about 20% of elderly patients acute admission to hospital is preceded by a fall³ which may itself result in increased values of

"cardiac enzymes".^{4,5} Such an increase in elderly patients may thus occur in the absence of myocardial damage leading to an erroneous diagnosis of AMI.

The MB isoenzyme of CK (CK-MB) has been reported to be highly specific for cardiac muscle damage.⁶ CK-MB, therefore, could be used to differentiate between myocardial and non-myocardial components in increased total CK activity. The facility to measure CK-MB activity may, however (as in this hospital), not always be available. In a recent study, for example, only two out of 19 hospital laboratories in the West Midlands routinely measured CK-MB activity.⁷

The serum creatine kinase:aspartate aminotransferase (CK:AST) ratio has also been used to distinguish between cardiac and skeletal muscle sources of increased CK activity, on the basis that skeletal muscle contains more CK and less AST per gram than cardiac muscle.^{8,9}

Methods

All patients admitted to an acute geriatric unit over three months between May and July 1988 were entered into the study. Each patient was clinically assessed, with particular emphasis on falls, and investigated with serial 12-lead electrocardiograms and measurement of serum CK, AST, and LDH activities within 24, 48, and 72 hours of admission.

Cardiac enzyme activities were analysed by standard techniques on a Cobas FARA (Roche Products, Welwyn Garden City, Herts., England) using reagents supplied by Roche Products and BCL (Lewes, Sussex, England). Reference intervals for CK, AST, and LDH were 17-188 IU/l, 12-32 IU/l, and 226-616 IU/l, respectively, and were established from 60 fit residents of local private rest homes with a mean age of 83.1 years (30 of whom were women).

A "faller" was defined as anyone who had been found lying on the floor on the day of admission, or who had fallen within two days before admission. AMI was diagnosed independently by three physicians on the basis of previously published criteria.¹⁰ An AMI was defined as a history sufficient to warrant hospital admission for AMI plus at least either an ECG characteristic of an AMI or an increase in one or more cardiac enzyme activities to greater than twice the upper limit of normal.

Patients, excluding those who had evidence of liver disease or a history of alcohol misuse, with an increased serum CK activity were

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Accepted for publication
9 September 1992

Classification of 86 patients with raised CK activity on first, second, and third days of admission

Day	Patients	Non-fallers		Fallers	
		No AMI	AMI	No AMI	AMI
1, 2, 3	86 (32%)	31	19	31	5
1	53 (20%)	18	12	19	4
2	55 (20%)	18	13	19	5
3	47 (17%)	17	11	15	4

then classified into four groups: non-faller, no AMI; non-faller, AMI; faller, no AMI; and faller, AMI.

The Mann-Whitney U test was used to assess the significance of differences between groups.

Results

There were 279 admissions to the acute geri-

atric unit over the period studied. Nine patients were excluded because of a failure to have either ECGs or cardiac enzymes done, leaving 270 patients whose mean age was 81.2 years and of whom 179 were women.

There were 25 (9%) AMIs of which 16, 18, and 15, respectively, had increased serum CK activity within 24, 48, and 72 hours of admission. Fifty two (19%) patients had fallen over within two days before admission or had been found lying on the floor. Of these 23, 24, and 19, respectively, had raised serum CK activities on the first, second, and third day of admission.

CK activity was raised in 86 (32%) patients on one of the three days following admission. Fifty three (19%), 55 (20%), and 47 (17%) patients had increased CK activity on days 1, 2, and 3 after admission, respectively. Classification of patients with increased CK activity is shown in the table. CK:AST ratios in those patients with an increased CK activity on days 1, 2, and 3 are shown in fig 1. The CK:AST ratio was higher on all days ($p < 0.01$) in "fallers" than in "non-fallers". On the second and third day of admission, the CK:AST ratio was lower ($p < 0.01$) in those patients with an AMI than those without. The overlap, however, between these groups was large (fig 1).

Receiver operator curves for the CK:AST ratio in the diagnosis of AMI in those patients with an increased CK activity on days 1, 2, and 3 are shown in fig 2.

Discussion

An increase in serum CK activity was common, occurring in about one third of patients admitted to this acute geriatric unit. Of these, a significant (35%) proportion had neither fallen nor had an AMI.

Garcia-Webb *et al* and Dufour obtained high sensitivity and specificity of 96% and 94%, and 94% and 90%, respectively, for the CK:AST ratio in the diagnosis of AMI.^{8,9} In this study, however, the CK:AST ratio was not sensitive or specific enough to be useful in the diagnosis of AMI in those elderly patients with raised CK activity. The CK:AST ratio was significantly higher in "fallers" without an AMI than in "non-fallers" with an AMI, and on the second and third days, it could differentiate between these groups. The large overlap, however, between these and the other groups made the CK:AST ratio unhelpful in differentiating between myocardial and skeletal origins of an increase in serum CK activity. A multiple tier cutoff, as proposed by Dufour,⁹ was similarly of little value.

This study was undertaken not to evaluate new tests but to optimise the current diagnostic tools. The results reported here suggest that the CK:AST ratio is of limited use when applied to the diagnosis of AMI in elderly patients, although a high value may help to exclude AMI in doubtful circumstances. This study also emphasises the importance of validating diagnostic tests in the clinical

Figure 1 The CK:AST ratio in aged patients with raised serum CK activities on days (A) 1, (B) 2, and (C) 3 of admission.

Figure 2 Receiver operator curves for the CK:AST ratio in the diagnosis of AMI in patients with increased serum CK activity on days (A) 1, (B) 2, and (C) 3 of admission.

environment in which they are to be used before being used in the laboratory's test repertoire. An increase in CK activity is common in acute geriatric admissions, and if CK-MB measurement or other determination of equal or better specificity for myocardial damage (such as troponin T) is unavailable, clinical evaluation of the patient rather than the pattern of enzyme change is more likely to determine the cause.

We are grateful to Drs MH Shakeel and MAS Hussain for allowing us to study their patients. We thank Dr PJ Cadigan for his advice and assistance in classifying patients. PGN and RG acknowledge financial support from the DoH.

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