

Reference ranges for serum creatinine and urea in elderly coastal Melanesians

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SUMMARY

Mean values and reference ranges are presented for serum creatinine and serum urea in Melanesian men and women aged over 50 years from coastal Papua. The values are presented separately for three age groups, 51-60, 61-70 and 71-85 years, but there was no significant difference between them. The values for women were lower than for men in all age groups.

Introduction

The calculation of 'normal ranges' is often based on an ill-defined population and a statistically unacceptable number of subjects. Frequently staff or medical students are used to determine these values which many times do not give a gaussian distribution and are only representative of a nontypical population. The International Federation of Clinical Chemistry has now carefully defined reference intervals based on reference values (1,2). This takes into account sample size, description of population, age, sex, race, exercise and posture. In particular, the importance of defining the reference population has been stressed and emphasis laid on the fact that some variables, notably age and sex, may have a significant effect.

Few published reports are available on reference values from the developing world especially in the elderly (>50 years). Both age and sex are known to affect the normal levels of many important and commonly measured blood constituents. Attempts to derive normal values for the elderly from data from hospital patients are less likely to provide convincing results than comparable data from less sick people, such as the elderly at home. This group is likely to increase in number as life expectancies increase and there is a steady decline in mortality rates.

In this study we report on reference values in the elderly for two commonly measured analytes, urea and creatinine, from a well-defined population from Papua New Guinea.

Materials and methods

This study was part of a larger survey which was carried out in 1991 to determine the prevalence of diabetes mellitus in three communities of Papua New Guinea (3): (a) Koki village - an urban squatter settlement of the capital city of Port Moresby; (b) Kalo village - about 135 km south-east of Port Moresby; and (c) Wanigela village - 200 km south-east of Port Moresby on the Marshall Lagoon. The degree of modernization varied between the villages. The residents of Koki relied on cash income from business or employment, while Kalo and Wanigela retained a more subsistence lifestyle, with diets based on fish and starchy staples. Though adults over the age of 25 years were surveyed in the larger study, only subjects aged 50 years and above were selected for this study. As both the Koki and Wanigela communities have a high prevalence of diabetes, all diabetic subjects were excluded from this study. Furthermore all subjects with known or suspected renal disease based on a detailed clinical history and physical examination were excluded. Despite this the possibility of occult

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disease could not be ruled out and remains a limitation of this study. Alcohol and tobacco consumption as well as variations in diet and muscle mass were not taken into consideration.

Each subject underwent a thorough physical examination and was interviewed by a trained assistant who was fluent in the local language. Because of the difficulty in establishing the age it was confirmed by relating to significant historical events. Specific questions were addressed to the presence of diabetes or tuberculosis and subjects with clinical or confirmed evidence of disease were excluded. A drug history was also obtained.

Fasting blood samples were collected between 0800 and 1100 hours. The samples were separated immediately and stored at -20 degrees centigrade until analysis which was performed within 1-2 weeks of collection. Creatinine was measured by a method based on the Jaffe reaction and urea by the urease method on a Technicon RA 1000 autoanalyser (first order reaction). Precision studies were performed using control sera (Precinorm). Coefficients of variation were 2.5% (intra batch) and 3.5% (inter batch) for creatinine and 4.5% (intra batch) and 5.0% (inter batch) for urea.

Patient data were analyzed according to sex and age groups 51-60, 61-70 and 71-85 years. Means and standard deviations were calculated for each age group and recalculated (4) after exclusion of outliers (>3.5 SD). The data were examined to determine if values had a gaussian distribution. Comparison of means between sexes was performed by an unpaired t test.

Results

Mean values and reference ranges in mmol/l for serum creatinine and serum urea in each age group are shown in Tables 1 and 2. Significant sex differences ($p < 0.01$) were observed with serum creatinine. Though the differences were small, concentrations were consistently higher in males than females for both creatinine and urea in each of the age groups. No significant differences were noted between age groups for either males or females.

Discussion

Few published reports exist on reference values for biochemical analytes from the developing world which are specific for age and sex. Ageing has been associated with numerous physiological changes, some of which are caused by the cumulative effects of pathological conditions. Since age, sex and muscle mass affect serum urea and creatinine concentrations, the results obtained in this study were not unexpected. However, despite the known effect of these variables on serum creatinine and urea, many laboratories continue to use for elderly patients reference values derived from a younger population. A study from Zimbabwe (5) reported on only male subjects and the reference values were also not age specific. This study has shown that significant sex differences exist with respect to both reference ranges and mean values (Table 1) and these differences should be taken into account when interpreting patient data. Though differences were not observed between mean values of the age groups in either of the

TABLE 1

MEANS AND REFERENCE RANGES FOR SERUM CREATININE (MMOL/L) IN ELDERLY COASTAL PAPUA NEW GUINEANS

Age (years)	No	Male		No	Female		p*
		Mean	Range		Mean	Range	
51-60	86	0.13	0.10-0.15	106	0.11	0.08-0.15	<0.01
61-70	54	0.13	0.10-0.18	71	0.12	0.07-0.18	<0.01
71-85	45	0.13	0.09-0.16	38	0.11	0.09-0.15	<0.01

*The means between the sexes were compared by t test, with statistically significant differences as shown by the p values

TABLE 2

MEANS AND REFERENCE RANGES FOR SERUM UREA (MMOL/L) IN ELDERLY COASTAL PAPUA NEW GUINEANS

Age (years)	No	Male		No	Female		p*
		Mean	Range		Mean	Range	
51-60	86	4.13	1.6-8.1	106	4.08	1.5-6.9	NS*
61-70	54	4.53	2.0-8.3	71	4.40	1.5-9.3	NS
71-85	45	4.47	1.7-8.7	38	4.43	2.3-8.5	NS

*The means between the sexes were compared by t test, with no statistically significant differences found

sexes, they are likely to be found if the values are compared to those in a younger population. Many laboratories in Papua New Guinea continue to use reference ranges that were derived from small volunteer populations more than ten years ago. Significant changes in instrumentation and methodologies make many of these values obsolete, which may even result in misdiagnosis. Furthermore, in our experience, some laboratories, due to time and financial constraints, have been using reference ranges supplied by instrument and reagent manufacturers. This is poor laboratory practice as significant ethnic differences have been reported in laboratory values, which may also be applicable to Papua New Guinea. For example, a recent study from USA found higher serum creatinine levels among elderly male blacks compared to caucasian males (6). Differences have also been observed between black African populations (7).

The values obtained in this study are significantly different from the current reference ranges being used at the Port Moresby General Hospital and other provincial hospitals. The results of this study highlight the importance of having separate reference ranges for an elderly population. It is hoped that the results of this study will stimulate the

establishment of age- and sex-specific reference ranges for other common biochemical analytes.

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