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Arterial blood gas analyzers Which is appropriate for point of care testing in the critical care unit?

OBJECTIVE Arterial blood gas analysis is a basic laboratory investigation in the critical care unit. In the past, a big problem in critical care management was the waiting period for arterial blood gas results from the laboratory. Currently, the new concept of point of care testing (POCT) helps to solve this problem. **METHOD** In this article, the properties of the 7 blood gas analyzers presently available in Thailand are assessed with a view to finding the model which is the best suited to POCT purposes. A property-utility analysis was made. **RESULTS AND CONCLUSIONS** The turnaround time per unit weight of 7 available analyzers was determined. According to the property per utility analysis, the OPTI CCA and the OPTO R are the arterial blood gas analyzers best suited for use in the POCT setting.

Arterial blood gas analysis is a basic laboratory investigation that is indicated for assessment of acid base, ventilation and oxygenation the patients.¹ Due to the need for arterial blood collection, it is considered as a laboratory procedure that is not routinely used in general clinical settings but it is an essential method for patient evaluation in critical care units (CCUs) such as the intensive care unit (ICU) and the emergency department.²

In the past, the arterial blood gas analysis was usually performed in the central laboratory and it was necessary to transfer the blood sample to the laboratory. This caused a big problem in critical care management, with the transfer followed by a wait for the laboratory result. Now the new concept of point of care testing (POCT) can help shorten the waiting time. POCT is based on the precept that the testing can be performed at the patient care site.^{3,4} For blood gas analysis, a number of new analyzers are in use that can be applied in the CCU. This is a report of the assessment of the properties of the blood gas analyzers presently available in Thailand and further appraisal to find those best for POCT purposes.

MATERIAL AND METHOD

This is a descriptive study. The author first collected the relevant

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data on the arterial blood gas analyzers available in Thailand, with the special help of a major POCT company in Thailand, Connect Diagnostics Thailand. For the assessment, the basic concept of the characteristics of a good POCT tool were taken into account, namely a small machine, with low weight and easy to use, for the effort-utility analysis. For this analysis, the basic principle of property per utility analysis was used. The utility in this study was defined as the weight of the analyzer, which is the actual load for setting the machine in the patient care unit, plus the turnaround time, which is the main requirement for any POCT analyzer.

RESULTS

Complete data were derived on the 7 arterial blood gas analyzers available in Thailand. The effort and utility identified for each analyzer and the turnaround time per unit weight from the effort-utility analysis are shown in table 1.

DISCUSSION

The POCT of arterial blood gases is extremely useful in critical care medicine, where the new version of the arterial blood gas analyzer must serve the POCT needs of the users. In the past, determination of arterial blood gases in the critical care situation was usually problematic

Table 1. Weight and turnaround time of the seven arterial blood gas analyzers available in Thailand.

Arterial blood gas analyzers	Weight (kg)	Utility (turnaround time: sec)	Turnaround time per unit weight
OPTI CCA	4.00	210	0.019
OPTI R	6.00	210	0.029
Nova Phox	8.20	90	0.091
Gem3000	13.40	70	0.191
Siemens 348	9.10	50	0.182
Roche Omni C	30.00	125	0.240
i STAT	0.63	288	0.002

because of the long waiting time between sampling and analysis, which caused difficulties in decision-making in the care of critically ill patients. With the recent introduction of POCT concept, the setting up of a blood gas analyzer that can work as a POCT analyzer in the CCU can solve this problem. Despite the new technology, there is no doubt that critical care workers are capable of quality control maintenance of a blood gas analyzer as a POCT device,

under the quality control testing parameters.⁵

As a basic principle, the small analyzer that can give the fastest result can be the solution for POCT. Every blood gas analyzer usually has good diagnostic properties but they may not all be suitable for use as a POCT analyzer.⁶ An effort-utility model was used for the assessment of the 7 available blood gas analyzers. Focusing firstly on the weight of the analyzers, most of the studied analyzers are light, with the exception of the Siemens 348 and the Roche Omni C, both of which weigh more than 10 kg, and are generally used in the central laboratory. Concerning the turnaround time, all the analyzers can give the result within 5 minutes, which is acceptable for a POCT tool.

Going on to further effort-utility analysis, the three analyzers that have the lowest turnaround time per unit weight are the iSTAT, the OPTI CCA and the OPTO R. However, the iSTAT has certain drawbacks that should be mentioned, namely, its requirement of a large blood sample and the need for reagent preparation that can lengthen the exact turnaround time. It is therefore suggested that either the OPTI CCA or the OPTO R would be the best arterial blood gas analyzers for use in the POCT situation.

ΠΕΡΙΛΗΨΗ

Αναλυτές αερίων αρτηριακού αίματος: Ποιος είναι καταλληλότερος για μια μονάδα εντατικής φροντίδας;

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ΣΚΟΠΟΣ Η ανάλυση των αερίων αίματος αποτελεί βασική εργαστηριακή εξέταση στις μονάδες εντατικής θεραπείας. Στο παρελθόν, η αναμονή για τα αποτελέσματα των αερίων αίματος από το εργαστήριο, για το χειρισμό αυτών των ασθενών, αποτελούσε ένα σημαντικό πρόβλημα. Σήμερα, το εν λόγω πρόβλημα έχει επιλυθεί με την επιτόπου μέτρηση (point of care testing, POCT). **ΥΛΙΚΟ-ΜΕΘΟΔΟΣ** Αξιολογήθηκαν και αναλύθηκαν οι ιδιότητες των διαθέσιμων στην Ταϊλάνδη αναλυτών αερίων αίματος αναφορικά με την αξιολόγηση του καταλληλότερου για τη μέτρηση πλησίον του ασθενούς. **ΑΠΟΤΕΛΕΣΜΑΤΑ** Καθορίστηκε ο χρόνος χρησιμοποίησης ανά μονάδα βάρους 7 διαθέσιμων αναλυτών. **ΣΥΜΠΕΡΑΣΜΑΤΑ** Σύμφωνα με την ανάλυση της χρησιμότητας, φαίνεται ότι οι καλύτεροι αναλυτές για τη μέτρηση των αερίων του αρτηριακού αίματος είναι ο OPTI CCA και ο OPTO R.

Λέξεις ευρητηρίου: Αέρια αρτηριακού αίματος, Αναλυτές, POCT

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