We zijn er in dit onderzoek vanuit gegaan dat de interferentie gelijk blijft, onafhankelijk van de hoogte van het resultaat van de analyse.

Conclusie
Het merendeel van de analyses op de c8000 analyzer is ongevoelig voor interferentie door HIL in het onderzochte bereik. Waar sprake is van analytisch- en klinisch-relevante afwijkingen, zijn grenzen ingesteld voor HIL-indices. Hierdoor kunnen resultaten van een opmerking worden voorzien, of zelfs komen te vervallen als de afwijking te groot is.

Referenties

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Factors reducing hemolysis rates at the emergency department

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Introduction
Preanalytical variables are recognized as the predominant source of mistakes in laboratory medicine (1). Among the various problems that occur in the preanalytical phase, in vitro hemolysis is often reported as the leading source of error. Hemolysis is defined as a rupture of red blood cells with release of hemoglobulin and other intracellular contents into plasma. When hemolysis occurs, the blood is unsuitable for many lab analyses (e.g. potassium, lactate dehydrogenase, aspartate aminotransferase, coagulation testing) (2), so a second specimen must be obtained, resulting in increased staff workload and patient discomfort. In addition, re-collection of hemolyzed blood specimens delays patient care in overcrowded emergency departments.
Blood collection using newly inserted intravenous (IV) catheters is the favoured technique in our emergency department for two main reasons. First, it is less time consuming to obtain blood from a newly established IV site than it is to find another site from which to obtain blood, which can results in unnecessary delays. The second main reason laboratory blood specimens are obtained using the IV catheter is patient comfort, with most patients preferring a single venipuncture. Hemolyzed samples negate the efficiency that is gained by combining blood collection and IV insertion into one venipuncture.

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In the period June to December 2008 we compared the number of blood samples arriving from our emergency department with the number of tubes from another department. The clinical chemistry section of our laboratory received 9,754 samples from internal medicine, drawn by venipuncture, and 8,710 tubes from the emergency department, drawn by IV catheters, for routine testing. In 105 specimens from internal medicine hemolysis was observed, compared to 574 samples from the emergency department. Thus, samples arriving from our emergency department showed a higher number of hemolyzed samples compared to other departments. In order to reduce those numbers a study has been designed to identify factors leading to hemolysis and evaluate blood collection practices.

Methods
A total of 600 samples were drawn for this study over a 3-month period. In total 150 patients were included, 100 at the emergency department and 50 at the outpatient clinic. From every patient at the emergency department four subsequent blood samples were collected via IV catheters. A standardized data collection form was completed, which detailed patient demographics, needle size, type of IV catheter (with an Eclipse needle with pre-attached holder or a direct draw adapter), puncture site and degree of difficulty. Similarly, patient specimens were collected using the standard venipuncture procedure used at the outpatient clinic. Samples were assayed for hemolysis and hemolysis-sensitive parameters on a Roche Modular system. Hemolysis was detected by using the automated hemolytic index (HI) function, which uses spectrophotometry to detect differences in absorbance at

570-600 and 600-700 nm. Based on these absorbances semi-quantitative values are calculated for the degree of hemolysis present in the sample. An arbitrary HI of 300 or more, corresponding to 186.3 µmol/L of haemoglobin, was used to define samples as hemolyzed.

Results

In our emergency department blood collection is from IV catheters in order to reduce the number of venipunctures. Our study shows that only blood drawn through IV catheters at the emergency department resulted in hemolysis (16% of samples). This is in contrast with specimens collected through venipuncture at the out-patient clinic, which exhibited no hemolysis.

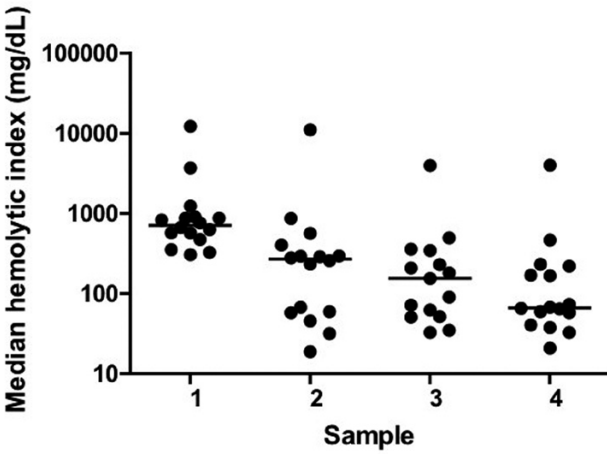

Figure 1. Hemolytic indices of subsequently drawn blood samples from patients with hemolysis in first blood sample (n=16).

Table 1. Blood draw variables

Blood draw variables	Total sample (n=100)	%of total hemolyzing
Difficult IV catheter placement		
No	77	8
Yes	23	**44**
IV catheter size		
18 gauge	34	15
20 gauge	65	17
No data available	1	
Blood collection		
Eclipse needle with pre-attached holder	86	12
Direct draw adapter	12	**50**
No data available	2	
IV placement site		
Left antecubital	31	13
Right antecubital	23	4
Left forearm	20	20
Right forearm	17	12
Left hand	3	**67**
Right hand	5	**60**
No data available	1	

This finding is in agreement with other studies, which state that drawing blood through intravenous catheters is associated with significantly more hemolysis than drawing blood with straight needles (3, 4). As indicated in figure 1, hemolysis occurred mostly in the first sample (median HI 718.5), while the remaining tubes showed no hemolysis (median HI indices 270, 156, 67 respectively in samples 2, 3 and 4). In case of hemolyzed samples, elimination of the first blood tube effectively reduced the number of hemolyzed samples presented for laboratory analyses with 75%.

Concerning the IV placement site, a hand puncture was identified as the major cause of hemolysis (60-67%) (table 1). Blood drawing categorized as difficult/unsuccessful venipuncture was also associated with an increase in the risk of hemolysis with 44%. Moreover, a high prevalence (50%) of in vitro hemolysis was related to the use of IV catheters with a direct draw adapter (table 1). Interestingly, no difference in hemolysis was found between smaller and larger needles in our study (table 1). This is in contrast to other studies, where smaller needle sizes were associated with greater occurrence of hemolysis (5, 6). Laboratory tests most influenced by hemolysis were potassium and lactate dehydrogenase.

Conclusion

In summary, drawing blood through intravenous catheters was associated with significantly more hemolysis than standard venipuncture. Blood draw collection factors with the highest hemolysis rates included blood drawing categorized as difficult, a hand puncture and the use of IV catheters with a direct draw adapter. The number of hemolyzed specimens send to the laboratory can be significantly reduced by elimination of the first blood tube. Therefore, we recommend in cases of difficult or hand punctures to discard the first blood tube. In addition, the use of an IV catheter with an Eclipse needle with pre-attached holder is advised under all circumstances. Changing these blood collection practices can reduce hemolysis and thereby improve turn around time, patient care and staff efficiency.

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