Technical methods

A modification of Hepatest, using the Terasaki plate, for the detection of HBsAg in blood donors

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A simple modification of Hepatest (Wellcome Reagents) is described, which lends itself to the rapid large-scale screening of blood donors. The technique uses 4 μl of HBsAb coated turkey cells (Cayzer et al., 1974), and Terasaki plates (Hopkins and Das, 1973), in contrast to the 25 μl used in the microtitre tray technique.

This results in a considerable saving on the cost of reagents, the cost per test being reduced to 16% of the cost of the recommended method. In our hands, this modification is as convenient to use as the manual microtitre tray technique.

Positive sera from the screen test are also tested for non-specificity using horse IgG coated turkey control cells. The false positive screen test rate has been reduced by the adoption of a modified buffer containing turkey serum.

Materials

Hepatest kit (Wellcome Reagents)
Terasaki plates and inclined plate stand
SMI Micropettor (Dynatech)
Oxford dispenser
Hamilton repeating dispenser (V. A. Howe)
Calibrated Pasteur dropping pipettes—0-025 ml

(a) Stock buffer
0·1 M Na2HPO4 12H2O 35·8 g/l (solution A)
0·1 M NaH2PO4 2H2O 15·6 g/l (solution B)

Solutions A and B are mixed together in proportions to produce a solution of pH 7·0 (100 ml of solution A + 92 ml of solution B). To this is added an equal volume of 0·15 M NaCl.

(b) Buffers for use—prepared fresh daily
i Original formula—stock buffer + 5% human group AB serum (HBsAg free), and 2% horse serum (HSO2 Wellcome Reagents).
ii Modified formula—stock buffer + 4% human group AB serum (HBsAg free), 2% horse serum (HSO2 Wellcome Reagents), and 2% pooled turkey serum.

Method

PRINCIPLE
Hepatest is a passive haemagglutination technique in which HBsAg in the serum under test causes agglutination of tanned, fixed turkey erythrocytes coated with affinity purified horse HBsAb (test cells). The specificity of this reaction is confirmed by the use of tanned, fixed turkey erythrocytes coated with horse IgG (control cells).

SCREENING TEST
Serum samples are received from the Blood Donor Laboratory in precipitin (50 x 7 mm) tubes in numbered perspex 50 hole racks. These are centrifuged to free the serum of red cells using the Griffin and Christ bench centrifuge with serological head.

0·225 ml of working buffer is dispensed into duplicate precipitin tubes, one drop (0·025 ml) of serum from a Pasteur dropping pipette is added to this tube from each serum sample, and these dilutions are well mixed. Using the Micropettor, 8 μl of each serum dilution is pipetted into a well of a Terasaki plate. When all the sera have been pipetted, 4 μl of well mixed Hepatest cells is dispensed into each well using the Hamilton dispenser.

The lids are replaced, and the plates are stood in the inclined plate stand for 30-60 minutes, on a vibration free surface, at an angle of 25° to 30° from the horizontal (fig 1).

CONTROLS
With each batch of samples, a titration of Hepatest positive control serum is incorporated. If the titre obtained with test cells is less than 1:32, the tests must be considered invalid and repeated using fresh reagents.

Results

The results are read macroscopically by placing the complete plate and stand over a diffused light source.

A negative reaction is seen as a crescent of settled cells, and a positive as a poorly formed or absent crescent, the agglutinated cells forming a carpet on the lower lip of the well (fig 2).

CONFIRMATORY TESTING
Doubling dilutions of any screen test positive sera are prepared from 1:4 to 1:64 in working buffer, and tested simultaneously with test and control cells. Any sample with a titre of 1:64 or above with either
cell, or having a test cell titre at least two doubling dilutions greater than that with control cells, is further tested in a 10 tube titre 1:4 to 1:2048 with both test and control cells.

For a positive sample, a duplicate titre is also performed taking serum direct from the 'Master' clotted sample to ensure correct sample identity.

A confirmed Hepatest positive sample, therefore, has a titre (a) greater than 1:4 with test cells, and (b) at least two doubling dilutions greater with test cells than with control cells.

Discussion

A total of 3310 samples were tested by both the microtitre tray method and this modification. Fifty-one samples were screen test positive by both techniques. Subsequent confirmatory testing showed
that 50 were false positives, and that one sample was
genuinely HBsAg positive.

The Quality Control panel B (Standards Labora-
tory, Central Public Health Laboratory, Colindale)
and 25 other known HBsAg positive sera were tested
while the original buffer was in use. Forty-four of the
45 were positive by this technique, the one exception
being a sample from a donor implicated in post-
transfusion jaundice, which had previously been
found positive for HBsAg by radioimmunoassay
(RIA) only (Dane, 1974). All of the 45 sera were
positive by RIA, and only 40 were detectable by
immunoelectro-osmophoresis (IEOP) at this centre.

Titrations of six known HBsAg positive sera were
also performed, and parallel testing showed that the
Terasaki plate technique is at least as sensitive as the
recommended method, and, as previously described,
passive haemagglutination is much more sensitive
than IEOP and closely approaches the sensitivity of
RIA (Christie et al, 1974).

The angle of the plate on the inclined plate stand
was varied from 15° to 50° from the horizontal.
Interpretation of the result, with a clear distinction
between positive and negative reactions, was found
to be easiest at 25° to 30°.

As in the microtitre tray technique, the results may
be read after 30 minutes, but the interpretation is
easier after 60 minutes.

Studies on the constituents of the original buffer
have shown that alterations in the amounts of horse
serum and human group AB serum have little
beneficial effect, but the introduction of pooled
turkey serum produces a marked reduction in the
false positive screen test rate (table I). From tables
II and III it is also apparent that this buffer does not
cause any loss of sensitivity of the Hepatest reagents.

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for their encouragement and advice, and Dr
Bradstreet for supplying the Quality Control panel.

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