Discrepancies between clinical and postmortem diagnoses in Jamaica: a study from the University Hospital of the West Indies

T N Gibson, S E Shirley, C T Escoffery, M Reid

Aims: It has previously been shown that the low necropsy request rate at the University Hospital of the West Indies (UHWI) in Jamaica (35.3%) results primarily from clinicians’ confidence in clinical diagnoses and laboratory investigations. This study aimed to determine the rates of discrepancy between clinical and necropsy diagnoses at the UHWI, because many previous studies from other institutions have shown persistent high rates of discrepancy, despite advances in medical investigative technology over the past several years.

Methods: Data were extracted retrospectively from consecutive necropsies performed at the UHWI over a two year period. The data were analysed to determine the categories and rates of discrepancy, and to determine the relation between discrepancy rates and age, sex, type and number of diagnoses for each patient, hospital service, and length of hospitalisation.

Results: Necropsies were performed on 446 patients; 348 were suitable for further analysis. The overall discrepancy rate was 48.4% and the diagnoses with the highest individual discrepancy rates were pneumonia (73.5%), pulmonary thromboembolism (68.3%), and myocardial infarction (66.7%). Males and older patients were more likely to have discrepant diagnoses. There was a high frequency of discrepancies in patients who died within 24 hours of admission, but there was no consistent relation between length of hospitalisation and discrepancy rate.

Conclusions: The high discrepancy rates documented at the UHWI are similar to those reported globally. This study supports previous attestations that the necropsy remains a vital tool for determining diagnostic accuracy, despite modern modalities of clinical investigation and diagnosis.

The necropsy is of tremendous value in the audit of diagnostic accuracy and in medical education. However, necropsy rates have shown a progressive decline, globally, over the past few decades, and this has been no different at our institution—the University Hospital of the West Indies (UHWI) in Kingston, Jamaica. We previously investigated the reasons for low necropsy rates at our institution, and found that the most common reasons for which clinicians failed to request necropsies were “confident clinical diagnoses” and “diagnoses confirmed by radiological or other laboratory investigations”. However, there have been many studies published that have shown high rates of discrepancy between clinical and necropsy diagnoses, and some have shown that diagnostic accuracy has not improved over the past 30 years, despite advances in medical investigative technology.

“Necropsy rates have shown a progressive decline, globally, over the past few decades”

The aim of our study was to determine the discrepancy rates at our institution. There are only a handful of published studies such as this from the developing world, and to the best of our knowledge, this is the first from the English speaking Caribbean.

MATERIALS AND METHODS

This retrospective study examined data from consecutive necropsies performed in the department of pathology, University of the West Indies (UWI), over the two year period January 1999 to December 2000. The department performs necropsies for deaths occurring at the UHWI—the 500 bed, multidisciplinary teaching hospital attached to the Faculty of Medical Sciences at the UWI in Jamaica. We recorded the age, sex, duration of admission, and clinical and necropsy diagnoses for each patient. Clinical diagnoses were defined as those listed by the clinician on the necropsy request form/patient death card and all diagnoses that were established or assumed, as indicated in the patient records. Diagnoses were classified according to organ system, and those that involved two or more organ systems (for example, sepsis) were termed multisystemic. Deaths caused by trauma, other unnatural causes, or iatrogenic complications were excluded from further analysis. All necropsies were complete and were performed according to standard methodology, including relevant histological assessment. Necropsy diagnoses were those listed on the final report.

The clinical diagnoses were further classified as being either concordant or discrepant with respect to the necropsy diagnoses using a classification system based on that proposed by Underwood as follows:

- Category I:
  - major discrepancy
  - missed principal diagnosis definitely affecting clinical outcome.

Abbreviations: A&E, accident and emergency; UWI, University of the West Indies; UHWI, University Hospital of the West Indies
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with the continuous variables. Differences in proportions were tested
Analysis of variance was used to compare means of
recorded as follows:

believe that identifying overdiagnoses and determining the
stated reasons: 58 had unnatural diagnoses only, 18
study period. Ninety eight were excluded from the study for
Necropsies were performed on 446 patients over the two year
RESULTS

We added a sixth category—overdiagnosis—to determine
what proportion of discrepant cases represented clinical
diagnoses uncorroborated at necropsy. These cases have been
noted in some previously reported studies, and we
believe that identifying overdiagnoses and determining the
diseases for which they were mistaken would be useful for
future clinical practice. This category of diagnoses was
recorded as follows:

All the study pathologists arrived at a consensus regarding the
categorisation proved ambiguous, the benefit of doubt was
awarded to the clinician. For example, where the necropsy
proved any one of multiple (differential) clinical diagnoses
proffered for a single case, the confirmed diagnosis was
considered concordant, even though the clinician had not
been definitive.
The data were used to calculate:

(1) The discrepancy rate—the number of discrepancies
expressed as a percentage of the total number of
diagnoses.

(2) The concordance rate—the number of concordant diag-
noses expressed as a percentage of the total number of
diagnoses.

These rates were then further analysed according to organ
system, specific diagnosis, hospital service, and duration of
admission.

STATISTICAL ANALYSIS

Data are expressed as frequencies, mean with standard
deviation, and median with interquartile range, as appro-
priate. The level of agreement between clinical diagnoses and
pathological diagnoses was assessed using the κ statistic.
Analysis of variance was used to compare means of
continuous variables. Differences in proportions were tested
with the χ² statistic. Logistic regression was used to examine
the relation between concordance, age, and length of
hospitalisation.

RESULTS

Necropsies were performed on 446 patients over the two year
study period. Ninety eight were excluded from the study for
the following reasons: 58 had unnatural diagnoses only, 18
were dead on arrival, 15 represented stillbirths/intrauterine

diagnoses. The systems exhibiting the highest discrepancy
rates were the gastrointestinal (60.0%), the respiratory
(57.7%), and the central nervous (54.4%) systems. There
was a significant association between the frequency of
concordant diagnoses and organ system. This association
remained significant after adjusting for age, sex, and total
number of diagnoses, such that there was a greater than
expected frequency of discrepant diagnoses in the respiratory
system, and lower than expected frequency of discrepant
diagnoses in the multisystemic category (p < 0.0001).
Category I and category VI diagnoses accounted for most of
the discrepancies.

Table 2 gives a breakdown of the 10 most common
discrepant diagnoses, which together represented 59.4% of
the discrepancies. The highest discrepancy rates were seen
with pneumonia (73.5%), pulmonary thromboembolism
(68.3%), and myocardial infarction (66.7%). When analysed
as a group, the top 10 discrepant diagnoses reflect the trend
of the total number of discrepancies, with most contributions
being made by diagnoses from categories I and VI (30.4% and
50%, respectively). Pneumonia, myocardial infarction, and
pulmonary thromboembolism made significant contributions
to category VI diagnoses (58.3%, 68.2%, and 55.8% of their

Figure 1 Age and sex distribution of the 348 patients.
total discrepancies, respectively). Twelve of the 21 patients with an overdiagnosis of pneumonia had necropsy or clinical and necropsy findings of pulmonary congestion and oedema, or congestive cardiac failure. The same was true of eight of 24 patients with an overdiagnosis of pulmonary thromboembolism and six of 15 patients with an overdiagnosis of myocardial infarction. There was no consistent necropsy finding in patients with overdiagnosis of cerebrovascular accident or infective endocarditis. Congestive cardiac failure was never overdiagnosed, but was clinically missed 50.0% of the time. Of the 10 most common discrepant diagnoses, eight were more commonly diagnosed in male than in female patients, with male : female ratios for these eight diagnoses ranging from 1.2 : 1 to 2 : 1 (table 3). However, this difference in sex distribution was not significant.

Table 4 shows an analysis of the data by service. Medicine includes: internal medicine (187), psychiatry (2), and gastrointesinal (35.5); respiratory (27.7); cardiovascular (16.0); and multisystemic (31.6). Table 1 shows an analysis of the data by system. The percentage of discrepancies observed, and on the discrepancy rate. Patients hospitalised for less than 24 hours accounted for 48.8% of overall discrepant diagnoses, and there was a progressive decline in the number of discrepant diagnoses with increasing duration of admission. The figure also shows that the discrepancy rate did not vary significantly from one time period to the next.

**DISCUSSION**

Previous studies on concordance between clinical and postmortem diagnoses have used a variety of classification systems and formulas to categorise the nature of the association between the clinical and postmortem diagnoses, and for the quantitative expression of diagnostic accuracy. As a consequence, direct comparisons with our data were not always possible. As previously mentioned, for diagnoses in which classification was ambiguous, the benefit of the doubt was given to the clinician. In any case, a previous study has shown that the discrepancy rate is not influenced significantly by the assessor (whether clinician or pathologist) of the type and level of the discrepancies.

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**Table 1** Category of discrepancy and concordance and discrepancy rates by system

<table>
<thead>
<tr>
<th>System</th>
<th>Total OD N (%)</th>
<th>Category of discrepancy</th>
<th>Total DD DR (%)</th>
<th>Total CD CR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory</td>
<td>168 (27.8)</td>
<td>I 12 1 1 1 1</td>
<td>97 57.7</td>
<td>71 42.3</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>160 (26.4)</td>
<td>I 12 1 1 1 1</td>
<td>97 57.7</td>
<td>71 42.3</td>
</tr>
<tr>
<td>Central nervous</td>
<td>68 (11.2)</td>
<td>I 12 1 1 1 1</td>
<td>97 57.7</td>
<td>71 42.3</td>
</tr>
<tr>
<td>Multisystemic</td>
<td>69 (11.4)</td>
<td>I 12 1 1 1 1</td>
<td>97 57.7</td>
<td>71 42.3</td>
</tr>
<tr>
<td>Genitourinary</td>
<td>42 (6.9)</td>
<td>I 12 1 1 1 1</td>
<td>97 57.7</td>
<td>71 42.3</td>
</tr>
<tr>
<td>Gastrointestinal</td>
<td>35 (5.8)</td>
<td>I 12 1 1 1 1</td>
<td>97 57.7</td>
<td>71 42.3</td>
</tr>
<tr>
<td>Reticuloendothelial</td>
<td>21 (3.5)</td>
<td>I 12 1 1 1 1</td>
<td>97 57.7</td>
<td>71 42.3</td>
</tr>
<tr>
<td>Haematological</td>
<td>13 (2.1)</td>
<td>I 12 1 1 1 1</td>
<td>97 57.7</td>
<td>71 42.3</td>
</tr>
<tr>
<td>Liver</td>
<td>7 (1.2)</td>
<td>I 12 1 1 1 1</td>
<td>97 57.7</td>
<td>71 42.3</td>
</tr>
<tr>
<td>Endocrine</td>
<td>7 (1.2)</td>
<td>I 12 1 1 1 1</td>
<td>97 57.7</td>
<td>71 42.3</td>
</tr>
<tr>
<td>Gall bladder and biliary tract</td>
<td>6 (0.9)</td>
<td>I 12 1 1 1 1</td>
<td>97 57.7</td>
<td>71 42.3</td>
</tr>
<tr>
<td>Musculoskeletal</td>
<td>4 (0.7)</td>
<td>I 12 1 1 1 1</td>
<td>97 57.7</td>
<td>71 42.3</td>
</tr>
<tr>
<td>Skin</td>
<td>3 (0.5)</td>
<td>I 12 1 1 1 1</td>
<td>97 57.7</td>
<td>71 42.3</td>
</tr>
<tr>
<td>Ear, nose, and throat</td>
<td>1 (0.2)</td>
<td>I 12 1 1 1 1</td>
<td>97 57.7</td>
<td>71 42.3</td>
</tr>
<tr>
<td>Breast</td>
<td>1 (0.2)</td>
<td>I 12 1 1 1 1</td>
<td>97 57.7</td>
<td>71 42.3</td>
</tr>
<tr>
<td>Total N (%)</td>
<td>605 (100)</td>
<td>I 12 1 1 1 1</td>
<td>97 57.7</td>
<td>71 42.3</td>
</tr>
</tbody>
</table>

**Table 2** Categories of discrepancy and concordance and discrepancy rates of the most common discrepant diagnoses

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Category of discrepancy</th>
<th>Total DD DR (%)</th>
<th>Total OD N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulmonary thromboembolism</td>
<td>18 0 0 0 0 24</td>
<td>43 68.3</td>
<td>174 (100)</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>11 0 0 0 0 21</td>
<td>43 68.3</td>
<td>174 (100)</td>
</tr>
<tr>
<td>Congestive cardiac failure</td>
<td>7 0 0 0 0 151</td>
<td>43 68.3</td>
<td>174 (100)</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>3 0 0 0 0 128</td>
<td>43 68.3</td>
<td>174 (100)</td>
</tr>
<tr>
<td>Sepsis</td>
<td>1 0 0 0 0 7</td>
<td>43 68.3</td>
<td>174 (100)</td>
</tr>
<tr>
<td>Cerebrovascular accident</td>
<td>6 0 0 0 0 1</td>
<td>43 68.3</td>
<td>174 (100)</td>
</tr>
<tr>
<td>Meningitis</td>
<td>3 0 0 0 0 1</td>
<td>43 68.3</td>
<td>174 (100)</td>
</tr>
<tr>
<td>Primary brain tumours</td>
<td>2 0 0 0 0 1</td>
<td>43 68.3</td>
<td>174 (100)</td>
</tr>
<tr>
<td>Infective endocarditis</td>
<td>2 0 0 0 0 1</td>
<td>43 68.3</td>
<td>174 (100)</td>
</tr>
<tr>
<td>Subarachnoid haemorrhage</td>
<td>0 0 0 0 0 1</td>
<td>43 68.3</td>
<td>174 (100)</td>
</tr>
</tbody>
</table>

*Eight of 24 patients had a necropsy (or clinical and necropsy) diagnosis of congestive cardiac failure; 112 of 21 patients had a necropsy (or clinical and necropsy) diagnosis of pulmonary congestion and oedema; or congestive cardiac failure; *16 of 15 patients had a necropsy (or clinical and necropsy) diagnosis of congestive cardiac failure; 16 of 7 adult patients had necropsy (or clinical and necropsy) changes of congestive cardiac failure.

DD, discrepant diagnoses; DR, discrepancy rate; OD, overall diagnoses.
The overall rate of discrepancy between clinical and postmortem diagnoses in our institution was 48.4%. There are no published data from the English speaking Caribbean with which to compare our figures, and although the methodology varied among studies, our discrepancy rate is comparable to the range of 28% to 60% calculated elsewhere. In some reports, the discrepancy rate was calculated for different decades, and it was shown that this rate has remained essentially unchanged, despite improvements in medical diagnostic technology over the past 30 years.

In some of the studies reviewed, only a single category of discrepancy or concordance was assigned to each patient, and in others it was not clear whether multiple or single categories were assigned. Both our study and that by Battle et al. reported multiple diagnoses, and therefore multiple categories, for each patient; however, whereas Battle et al. did not report an influence of number of diagnoses on the discrepancy rate, we showed that patients with multiple clinical diagnoses were less likely to show concordance than those with a single clinical diagnosis (p < 0.0001). This is understandable, because it is likely that multiple clinical diagnoses are often made in situations of uncertainty.

It has been reported previously that older patients have a lower frequency of concordant diagnoses, whereas others showed none. However, whereas we found a lower concordance frequency for male patients, Battle et al. noted that female patients had a significantly greater risk of dying with a major discrepancy. In our study, those diseases that were most frequently discrepant were diagnosed more often in male than in female patients, but this finding was not significant.

Our data indicate a high rate of discrepancy for respiratory system diagnoses and for myocardial infarction (66.7%). The highest discrepancy rates were seen with pneumonia (73.5%) and pulmonary thromboembolism (68.3%). Pulmonary thromboembolism was also among the most common discrepant diagnoses in other studies, with discrepancy rates ranging from 46.8% to 75%. These three diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions to category VI, and it was found that large proportions of patients with these diagnoses made major contributions.

Discrepancies between clinical and postmortem diagnoses in Jamaica...
Like Battle and colleagues\textsuperscript{7} and Olle-Goig et al.\textsuperscript{10} we documented a high frequency of discrepancies in patients hospitalised for less than 24 hours, and similar to the findings of Battle et al.\textsuperscript{2} there was no consistent relation between overall duration of hospitalisation and discrepancy rate. The lower than expected frequency of concordant diagnoses from the A&E department (p < 0.0001) correlates with the high frequency of discrepancies seen in the “less than 24 hour” period of hospitalisation. Although it is possible that short periods of hospitalisation (< 24 hours) may preclude detailed examination and investigation, Battle and colleagues\textsuperscript{7} have suggested that expected decreases in discrepancy rates with time may be hindered by the failure of clinicians to recognise new signs and symptoms in patients already being treated for other diseases.

It has been suggested previously that the global decrease in necropsy rates may cause artefactual increases in discrepancy rates, because perhaps only more difficult cases are now being necropsied.\textsuperscript{23, 24} Whether this is true or not, the results of our study support previous attestations that the necropsy remains a vital tool for determining diagnostic accuracy, despite modern modalities of clinical investigation and diagnosis, and also show that developing nations exhibit trends in diagnostic accuracy that are similar to those in more developed countries. Discrepancy rates will only decrease when more necropsies are requested, allowing clinicians to appreciate the “different faces” of various diseases, and allowing continual audit of diagnostic accuracy.

\textbf{Figure 2} Discrepancy proportions by duration of admission.

\begin{figure}[ht]
\centering
\includegraphics[width=\textwidth]{discrepancy_proportions.png}
\caption{Discrepancy proportions by duration of admission.}
\end{figure}

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\textbf{REFERENCES}

5. Gibson TN, Escoffery CT, Shirley SE. Necropsy request practices in Jamaica: a study from the University Hospital of the West Indies. J Clin Pathol 2002; 55:608–12.

\textbf{Take home messages}

- The overall discrepancy rate between clinical and necropsy diagnoses at the University Hospital of the West Indies was 48.4% and the diagnoses with the highest individual discrepancy rates were pneumonia (73.5%), pulmonary thromboembolism (68.3%), and myocardial infarction (66.7%).
- These high discrepancy rates are similar to those reported globally.
- This study supports previous attestations that the necropsy remains a vital tool for determining diagnostic accuracy, despite modern modalities of clinical investigation and diagnosis.
Blood culture in community acquired pneumonia

In the USA there are about four million cases of community acquired pneumonia (CAP) per year with an annual mortality of 45,000. There has been controversy about the value of routine blood culture and researchers at a hospital in New York City have provided evidence against.

The retrospective cohort study included 355 patients out of a total of 821 patients with CAP admitted to hospital from the emergency department between January 1999 and March 2001. For inclusion, patients should not have been in hospital in the last two weeks or live in a nursing home, should have been immunocompetent, and should have had X-ray evidence of pneumonia and at least one set of blood cultures taken. The average age of the 355 study patients was 60 (range 18–94) and 187 (53%) were women. Blood cultures from 70 patients were positive. They were deemed false positive (growth considered to be contaminant and patient treated accordingly) in 37. The growths in these 37 cases were of *Staphylococcus epidermidis* in 14 cases, coagulase negative staphylococci (18), diphtheroids (2), *S epidermidis* plus diphtheroids (1), and coagulase negative staphylococci plus diphtheroids (2). The blood cultures from the 33 patients regarded as having true positive (non-contaminant) cultures grew *Streptococcus pneumoniae* (30), *Staphylococcus aureus* (2), and *Staphylococcus haemolyticus* (1). Two thirds of the patients (238) had their antibiotic treatment changed whilst in hospital. These included 187 (65%) of the 285 patients with negative blood cultures, 25 (76%) of 33 with true positive blood cultures, and 26 (70%) of 37 with false positive blood cultures. Eighteen patients (5%) had their antibiotic treatment changed in response to the blood culture result. No patient had a change of antibiotic treatment because of antibiotic resistance.

About half of positive blood cultures in this series grew presumed contaminants. Overall, 18 patients (5%) had their antibiotic treatment changed in response to the blood culture results (10 of 33 true positives, six of 37 false positives, and two of 285 negatives). The response was a broadening of antibiotic coverage in seven cases and a narrowing in 11. No pathogen isolated was resistant to the antibiotic or antibiotics used as initial empirical treatment. In 246 cases (69%) initial treatment was with either a cephalosporin alone (76) or a cephalosporin plus a macrolide (170).

The authors of this paper question the use of routine blood cultures for immunocompetent patients with CAP. Restricted use of blood cultures would save on the direct costs of blood culture and might also reduce the duration of hospital stay.