Problems with scoring bruises

We write to draw attention to two problems with the recent study on a scoring system for bruising by Dunstan et al.1

Firstly, the authors did not publish confidence intervals for the likelihood ratios (LRs) derived from different score threshold values (table 3), thereby not allowing readers to judge whether the LRs are statistically—let alone clinically—significant.

Secondly, the authors neglect the phenomenon of spectrum bias. This is a well described feature of many tests, whereby sensitivity and specificity (and hence derived LRs) of a test vary with disease severity or prevalence. Examples of spectrum bias have been described with several tests including exercise stress testing2 and UTI diagnosis.3

The study population had a prevalence of physical abuse of 40%, much higher than the general paediatric population. Since test performance—that is, LR—is not independent of the pre-test probability, the LRs generated by a study done on this population cannot necessarily be used in a population with a much lower prevalence of abuse, as the authors have done in table 4. Since spectrum bias tends to reduce test performance as the pre-test probability falls, the LR for any given score threshold would be smaller than that quoted when applied to a population with a lower prevalence of physical abuse.

As most settings would expect to have a lower prevalence of physical abuse than the study, this reduces the value of the proposed scoring system as a clinical tool.

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References

Does cefotaxime eradicate nasopharyngeal carriage of N meningitidis

We enrolled 43 children admitted with an unequivocal clinical diagnosis of meningococcal sepsis into a study to determine whether cefotaxime eradicated nasopharyngeal carriage of N. meningitidis. In 28 cases (70%) the diagnosis was confirmed by positive culture from blood, nose, throat, or skin scraping, detection of meningococcal DNA in blood by polymerase chain reaction, or convalescent meningococcal serology. All children were treated with intravenous cefotaxime for seven days. Nasopharyngeal and throat swabs were obtained on the day of admission in 42 of these children, and all children had swabs repeated every day until there were at least two negative swabs.

On admission, the throat and nasopharyngeal swabs were both positive for meningococcus in two patients; in another two patients, the nasopharyngeal swab was positive while the throat swab was negative. In three patients the swabs became negative after 24 hours of treatment, and in one child it became negative after 48 hours. In these children and others in whom the swabs were negative from the day of admission, subsequent swabs remained negative.

Compared to a previous study4 that reported a nasopharyngeal carriage rate of 50% on admission and showed that the yield of meningococcus in throat swabs was unaffected by prior administration of penicillin, the yield from throat and nose swabs in this study (9.5%) was poor. This may reflect the fact that in practice throat swabs were not obtained in all children—some children had been given the first dose of cefotaxime. The initial yield of cefotaxime, like erythromycin,5 is effective in eradicating nasopharyngeal carriage, and in children treated with cefotaxime, additional prophylaxis with rifampicin is not necessary. However, no recommendations for the use of cefotaxime alone can emanate from these findings as the sample size was small and study design did not compare cefotaxime with gold standard treatment (either rifampicin or ceftriaxone). We are keen to coordinate a follow up multicentre study this winter involving paediatric intensive care units across the country to compare the efficacy of ceftriaxone with cefotaxime on eradication of meningococcal carriage. Interested units are kindly requested to contact us.

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References

Pneumocystis carinii pneumonia in an infant with transient hypogammaglobulinaemia of infancy

Transient hypogammaglobulinaemia of infancy (THI) is characterised by prolongation of the physiological decline in serum immunoglobulin concentrations seen in the first six months of life.4 The incidence reported from an Australian paediatric centre was estimated as 23 per 10 000 live births.5 It has been reported that THI does not usually predispose to significant infection.6

A male infant born at term to non-consanguineous parents presented at 3.5 months with cough, tachypnoea (70 breaths/minute), wheeze, crepitations, and hypoxia. A chest x-ray and radiograph showed consolidation and patchy opacification in the hilar regions and upper lobes. Pneumocystis carinii was identified in bronchoalveolar lavage by toluidine blue staining. The immunological findings of this child were consistent with those of THI with an IgG level less than the fifth centile and absent serum IgA7 which resolved with age (IgG at presentation 3.9 g/l (normal: 1.39–8.04); at 5 months 2.23 (1.39–8.04); at 10 months 1.77 (2.02–11.76); at 17 months 7.51 (2.71–13.78); IgA at 5 months <0.07 g/l (normal: 0.14–0.69); at 13 months 0.14 (0.17–1.34) and evidence of specific antibody production to tetanus, diphtheria, and Haemophilus influenza type b following immunisation.1 T cell numbers (total lymphocytes 6.2 × 109/l, CD3 68%, CD4 56%, CD8 15%) and phytohaemagglutinin induced proliferation were normal. At 3 years the child was well with normal IgG, IgA, and IgM levels.

Pneumocystis carinii pneumonia presenting in the first three months of life is an infection typically seen in patients with significant T cell immunodeficiencies and X linked hyper IgM.4 These were excluded by normal T cell numbers and function and by normal CD40 ligand expression and mutation analysis. There are reports of Pneumocystis carinii pneumonia in immunocompetent infants9 and agammaglobulinaemia.4 This is the first description of Pneumocystis carinii pneumonia in a patient with THI.

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Procalcitonin as a prognostic marker in children with meningococcal septic shock

Carrol and coworkers confirm the findings from Karabocuoglu et al who reported that procalcitonin (PCT) was higher in children with severe meningococcaemia (fever, petechiae, purpura, and hemodynamic instability) than in children with systemic meningococcal infection without shock (291.29 ± 167 v 19.7 ± 23 mg/l; p<0.001). Unfortunately, information is lacking in the report of Carrol et al, namely: a clear definition of severe MCD (defined in their paper as a Glasgow Meningococcal Septicaemia Prognostic Score >8) and median PCT values (69.8 mg/l; range 5.6–461). In our study, PCT on admission was an accurate predictor of mortality in the subgroup of children with meningococcal septic shock (MSS). We prospectively investigated 35 children (median age: 16 months; Q1-Q3: 9.3–45) with MSS (defined as ecchymotic or necrotic purpura with shock, needling fluid expansion (median for the first 24 hrs: 90 ml/kg; Q1-Q3: 48–120) and catecholamine infusion) admitted to our PICU between July 1999 and May 2002. We estimated the accuracy in predicting death of PCT, C reactive protein (CRP: nephelometry) on admission, and the Pediatric Risk of Mortality (PRISM) score in 35 children with MSS (PCT v PRISM value, p=0.45; CRP v PRISM value, p=0.31; PCT v CRP, p<0.06; CRP v PRISM value, p<10–4; CRP v PRISM probability, p<10–5).

In our study, PCT on admission was as accurate as the PRISM value and PRISM probability of death calculated within 24 hrs of admission or at the time of death, and more accurate than the CRP level in classifying survivors and nonsurvivors of MSS. These results accord with those of Hatherill et al who observed, in 37 children with MSS, that admission PCT level (values not indicated) was higher in nonsurvivors (11%) than in survivors (p=0.04) and related to the severity of organ failure (p=0.02); however, in the whole group of children with septic shock whatever the causative organism, admission PCT functioned worse than the PRISM score (AUC 0.73 (0.59–0.88) v 0.83 (0.71–0.93); statistical comparison not performed). The PRISM score is accepted in PICUs worldwide and has been reported to accurately predict outcome of meningococcal disease. It is reassuring, we would like to express some concerns and raise some questions about the data presented. The first question is whether the ascertainment of cases is really as complete as the authors suggest. We acknowledge that the UK medical system may allow better reporting and access to mortality data than that of the US. However, the records acquired as described seem to represent the same underreporting issues as those in the US. Is it really unlikely that the BPSU misses a significant number of cases? Based upon a well characterised population in Olmstead county Minnesota and extrapolating the data to a US population of 280 million, it may be estimated that there are 200 deaths from anaphylaxis reactions to foods each year.

Table 1

<table>
<thead>
<tr>
<th>Severity index (%)</th>
<th>PCT</th>
<th>CRP</th>
<th>PRISM value</th>
<th>PRISM probability</th>
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<td>Sensitivity</td>
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<td>64</td>
<td>100</td>
<td>91</td>
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<td>Positive predictive value</td>
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<td>87</td>
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<tr>
<td>Negative predictive value</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>95</td>
</tr>
<tr>
<td>Overall</td>
<td>74</td>
<td>51</td>
<td>74</td>
<td>86</td>
</tr>
</tbody>
</table>

References

higher number of cases were reported from rural regions as compared to metropolitan areas strongly suggesting either misdiagnosis or inaccurate recording of cases in the emergency department log of busy hospitals. A second concern is the reporting of cases only up to age 15. In the paper mentioned above, of 32 fatalities 10 occurred in youngsters up to age 15. An additional 10 occurred in adolescents aged 16 to 19. Why did MacDougall et al not include all adolescents? A third question must always be raised when fatal food anaphylaxis is studied. Is it not possible that cases of fatal asthma were actually initiated by unidentified allergic reactions to food? All authors in this field are likely to agree that the ultimate cause of death may be irreversible airway obstruction, and all would agree that poorly controlled asthma increases the risk of fatal anaphylactic reactions to food, but we would suggest that the trigger responsible for individual asthma fatalities is not always determined. What about fatalities that never reach the emergency department and are misclassified on death certificates as asthma fatalities? Individuals that die at home and are classified as asthma deaths are unlikely to be further investigated neither the US or the UK. Fourthly, the authors’ definition of severity seems incomplete. Individuals with severe food reactions who self administer epinephrine often do not go to hospital, are less likely to have reactions that require hospitalisation or cause death, and often they do not report these reactions to their physicians unless specifically queried. Some survive the reaction without treatment, become convinced that they have avoided a specific food, and never tell their physician. We could argue about the possible progression of these episodes to near fatal or fatal reactions, but the point we believe is that these are frequently under reported. The fifth concern issues the safe administration of epinephrine. We disagree about the risk to children of the administration of a single dose of epinephrine as opposed to withholding that dose. We have no disagreement about aggressive treatment of asthma concurrently, and in fact we think that disagreement about the risk to children of the administration of epinephrine often do not go to hospital. However, we do not know the proportion and said as much, excluding this group from our definition of severity. Finally, we agree that education of professionals and the public should continue based on the best available data. This must include those parents whose children are truly at high risk as well as those many parents that think any immediate hypersensitivity reaction to food means their child is at high risk of an allergic death; when in reality the risk, the absence of asthma, seems to be low. Differ ent parents will come to different views about how to proceed faced by a severe but very small risk, just as we all do in many aspects of our lives.

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Physiologic management of DKA

Inward and Chambers provide a provocative description and discussion of the continuing confusion regarding the issues surrounding rehydration and treatment of the pediatric patient with diabetic ketoacidosis (DKA).1 They review some of the key issues that link fluid therapy to complications from brain swelling, and question the appropriateness of using a volume of fluid calculated by "maintenance plus deficit", calling for a second revolution in the management of DKA. In the accompanying commentary, Edge makes several statements concerning fluid therapy in DKA, including that "DKA is associated with severe fluid losses", that "any guidelines for fluid and electrolyte management must be simple to calculate", that administration of DKA is a risk factor for additional complications, and that despite published articles and "changes in protocols", there is no evidence that the "incidence of cerebral oedema has changed over the past 20 years".

It is our opinion that the problem in the rehydration of the pediatric patient with DKA
does not lie in assigning a maintenance fluid allotment. Rather, the source of error lies largely with failure to accurately estimate the volume of deficit and the tendency to automatically assume a severe degree of dehydration. From our experience with over 450 consecutive cases of moderate and severe DKA, and our weight gain data, severe DKA (ie severe ketoacidemia) does not necessarily mean severe dehydration; the converse is also true. 10,11 The degree of dehydration ranges from negligible (<1 %) to extreme (>20 %). 12

Severe ketoacidemia, however, does cause vasoconstriction which may be manifested peripherally by cool, mottled skin, and Kussmaul breathing which leads to very dry oral mucosa. The striking appearance of a parched mouth and the presence of cool, even mottled skin without a critical assessment of vital signs and examination of distal (foot) pulses often results in an erroneous impression of shock and “severe dehydration.” 13 A method for estimation of the volume of deficit was described in 1990 14 and we continue to use this adjustment regularly. Successfully titrated fluid therapy requires not only gradual deficit replacement (evenly over 48 hours) but an accurate estimation of the volume of deficit along with careful attention to the clinical and biochemical response. If the deficit is assumed to be 10–15 % but is actually only 3%, that patient will receive excess water independent of the more gradual timeframe and independent of the rehydration fluid given. Guidelines that have proposed “safe” limits to fluid volumes administered such as 4 litres/m²/day or 50 kg body weight/4 hours violate the concept of the individualised assessment of the degree of deficit. Unfortunately, failure to monitor will result in the child being hydrated beyond the need for rehydration; the problem is compounded when actual body weight is used instead of ideal body weight in fluid allotment. The patient will remain severely dehydrated even when mannitol was given. On the other hand, certain patients, particularly those with complicating illness—for example, septic shock, pancreatitis—may require more than 20 ml/kg of fluid resuscitation in the first treatment hour and more than 50 ml/kg in the first four hours. Setting arbitrary fluid volume limits per hour or per day endanger particularly those patients at the mild and severe ends of the dehydration spectrum. Although the insulin dose should be greater with hypertonic fluid, overhydration occurs readily with isotonic fluid as well when water requirements are overestimated.

DKA represents the effects of a complex disruption of normal metabolism, which leads to metabolic death if left untreated. Shock (decreased peripheral pulses, with or without hypotension), if present, should be corrected rapidly. Insulin should be given preferably by continuous, low dose, intravenous infusion, as soon as possible to begin correction of ketoacidemia/ketoacidosis. Regardless of the serum concentration of glucose, insulin is required to prevent the hepatic fatty acid/carnitine cycle leading to ketoacidosis formation. A delay in insulin administration only serves to enhance and prolong ketoacidemia, thereby extending the period of time for which the patient remains vulnerable to central nervous system and other complications.

Our proposed management strategy may not satisfy the call for simplicity but it is an easily learned approach. It requires an understanding of relevant, known pathophysiology, the monitoring of serial physical examinations and laboratory studies with special attention to correction of acidemia and osmolality, and the anticipatory care that is inherent in the care of the critically ill. 16–18 Physiologic management was first described between 1988 19 and 1990, and set forth with additional detail and data in 1994. 20 It is rarely described in its complete form when referenced in texts; mere portions of our recommendations are taken and what we have called physiologic management. Not only is it unlikely that large numbers of patients outside our own institution have been managed using our guidelines in their entirety, but, in fact, the recommendations simply are not 104 long enough to be reflected in data over the past 20 years. We suspect that physiologic management is significantly underrepresented in the protocols and decision trees conducted thus far, all of which compare variations of traditional therapy (empiric volume resuscitation whether or not shock is present, assumption of a large volume of deficit, planned rehydration in less than 48 hours with either 0.45% or 0.9% NaCl, with or without urinary output replacement). In a retrospective portion of our study in 1990 20 we compared these same therapies and found that 0.45% saline did not work as well as the addition of normal saline which minimised the risk of brain herniation during treatment.

Comments regarding the administration of mannitol base should be better defined. Rapid administra- tion or “pushes” of hypertonic sodium bicarbonate should not be given. On the other hand, there is no evidence that administration of physiologic concentrations of base in the rehydration fluids is either harmful or desirable. In our experience, this practice mitigates the development of hyperchloremic acidosis during treatment.

As ours is a referral centre, most of our patients have been on acute therapy initiated in outlying hospitals, sometimes in keeping with our recommended approach, and sometimes with our recommendations instituted only after initial contact. In this setting, we have managed certain patients with severe DKA who received resuscitation fluids in excess of what their physical examination and laboratory data would dictate. It is not unusual for such patients to require as little as a typical maintenance volume allo- tame (without a deficit replacement component) for the remainder of therapy; some patients required fluid restriction as to little as two thirds the usual maintenance vol- umes.

Our approach has been criticised because of the incidence of mannitol administration in our series. In our mannitol recipients, several of whom did not receive their initial manage- ment by us, there was no central nervous system morbidity or mortality. In another large series of patients there was a 50% failure rate of mannitol to reverse a deteriorating neuro- logic status, even when mannitol was given before respiratory arrest, with a near 100% failure rate when mannitol was given after respiratory arrest. 4 It is possible that not all of our mannitol recipients actually had raised intracranial pressure. We believe, however, that the key to our good outcome is that the fluid and electrolyte therapy on which mannitol is superimposed is relevant to its success. It is erroneous to assume that 100% success rate among our mannitol recipients would be reproducible in the setting of a therapy that violates the fundamental principles of rehydra- tion. The hyperosmolar state. DKA.

Dr Inward and Chachkrors ask “do we have it right yet?” and convey concern that certain recommendations do not, as of yet, “have it right”. We agree.

Our work regarding the management of the pediatric patient in moderate to severe DKA has spanned 14 years 21 and nearly 500 consecutive prospectively managed episodes. We remain available to participate in any endeavour to continue to improve the care of the paediatric patient in DKA.

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References

The Position Statement on Injection Technique
The Position Statement on Injection Technique (March 2002, Royal College of Paediatric and Child Health) discusses needle size and length for childhood immunisation. It concludes that there would seem to be insufficient evidence to advise any recommen- dation to change current practice in the use of pre-filled syringes. As the authors of a research study that aimed to provide some evidence base for immunisation practice we would like to respond to this. 22

Our study of 119 babies aged 4 months receiving their third dose of DTP/IPV vaccine found that significantly less redness and swelling occurred when infants were immunised using the longer 23 gauge 25mm (blue hub) needle rather than when the shorter 25 gauge 16mm (orange hub) needle was used. The magnitude of the reductions was substantial. The position statement is correct to note that in our study the difference in tenderness did not reach statistical signifi- cance. However we believe our study still
justifies a recommendation for the use of the longer needle for immunisation in 4 month old infants.

We believe the non-significant difference in tenderness with the different needles must be interpreted with caution, and should not be taken as a rationale for ignoring the significant benefits in terms of reduced redness and swelling. Tenderness was in fact reduced by the same relative amount as redness, but as tenderness occurred less frequently, the results were not formally statistically significant. We have used Bayesian analyses (using an “uninformative” prior distribution) to formally compute the chance that there is a clinically significant reduction (of at least 25% as specified in the protocol) in tenderness between the long and short needles. At six hours the probability of a clinically significant decrease in tenderness with the longer needle is 73%, whereas the chance of a clinically significant increase is only 2%. The evidence is therefore clearly in the direction of the longer needle causing less harm.

We recognise the need for further evidence on which to base immunisation practice at each of the infant immunisation ages. To this end, we are now conducting a randomised controlled trial involving over 600 infants aimed at providing a definitive answer. In the meantime, we reiterate our recommendation to practitioners to use the longer needle for immunising 4 month old infants.

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Reference

The paper by Parkin et al in the September issue of Archives (Arch Dis Child 2002;87:221–2) was missing acknowledgements. The following paragraph should have been included:

Rita Arseneault, Audrey Bell-Peter, Diana Cohen, Pauline Matthews, Suzanne Stewart, and Olwen Tennis participated in patient enrollment and data collection. Derek Stephens assisted in statistical consultation. Rose Cheung and Carol Collins did the immunofluorescence microscopy and virus isolation tests. Dr Raymond Tellier oversaw virus testing for part of the time while he was on service.

Funding: This work was supported in part by grants from the Hospital for Sick Children Research Institute and the American Academy of Pediatrics. The Paediatric Outcomes Research Team is supported by a grant from the Hospital for Sick Children Foundation.