of increased blood flow', the causes of which are multifactorial 'leading to breakdown of the blood brain barrier with resultant oedema or haemorrhage'. We do not, and cannot, exclude a possible role for venous infarction, though our emphasis is on ischaemic infarction. We are aware, however, of the limitations of both the clinical and pathological approach to neonatal neuropathology, and we are in complete agreement with Levene that resolution of these differences of opinion will largely depend on more sophisticated techniques that allow the study of the genesis and evolution of the lesions during life.

As to the direction of our arrows we were unaware of any correlation between either the name or spelling of these missiles and the accuracy of their flight, though we cannot deny our spelling error.

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Plasma concentrations after oral or intramuscular vitamin K₁ in neonates

Sir,

We were interested to see the article by McNinch *et al*¹ regarding plasma concentrations of vitamin K₁ in neonates. Their data clearly show that after a pharmacological dose of vitamin K₁: (1) plasma concentrations of vitamin K₁ are considerably higher after intramuscular than oral administration; (2) there is considerable interindividual variation in plasma vitamin K₁ concentrations both after oral and intramuscular administration; and (3) the minimum plasma concentrations of vitamin K₁ achieved are considerably higher after intramuscular administration (≈ 300 ng/ml) than oral administration (0-4 ng/ml).

If prophylactic treatment is to be given to prevent haemorrhagic disease of the newborn then it needs to be effective in *all* babies. Thus the minimum plasma concentration achieved is more important than the median plasma concentration. In the two babies in whom vitamin K₁ was not detectable after oral administration the authors state that it was possible that sufficient vitamin K₁ was absorbed and that neither baby developed haemorrhagic disease of the newborn. Firstly, it is unlikely that either baby would develop haemorrhagic disease as the incidence is so low. Secondly, as the plasma concentration of vitamin K₁

required to ensure adequate clotting factor synthesis in the newborn is not known the authors cannot conclude that their practice of administering oral vitamin K₁ is safe.

Oral vitamin K₁ is possibly an effective prophylaxis in all healthy babies. Until the minimum plasma concentration of vitamin K₁ required has been determined, however, and this has been shown to be achieved in all babies after a single oral dose of vitamin K₁, then routine oral vitamin K₁ cannot be justified. As haemorrhagic disease of the newborn is a life threatening condition the data presented by McNinch *et al* support the routine administration of intramuscular vitamin K₁ to all newborn babies. The extra cost involved is minimal, and also the incidence of adverse reactions to intramuscular vitamin K₁ is negligible.

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Dr McNinch and co-workers comment:

We thank Drs Choonara and Park for their interest. We were careful not to suggest that our absorption study proved the administration of oral vitamin K₁ to be 'safe' in the sense of providing certain prophylaxis against haemorrhagic disease of the newborn. The efficacy of prophylaxis can be shown only in clinical practice, but evidence so far strongly suggests that a 1 mg oral dose of vitamin K₁ is effective. In 1982 Dunn² reported one case of haemorrhagic disease of the newborn among 31 000 babies receiving such prophylaxis and has seen no further case since (personal communication). In Exeter we have seen no case in some 12 000 babies since adopting the policy outlined in the paper. As clearly stated, we believe that our results together with reported clinical experience 'give support to the practice of using oral prophylaxis in well, mature babies', but further research is necessary to determine the optimal dose.

Regarding the two babies in whom vitamin K₁ was not detected, we suggested that sufficient vitamin K₁ might have been absorbed 'to raise the plasma value well beyond endogenous concentrations'—that is, beyond the estimated cord blood concentration of 0.02 ng/ml³—the limit of detection in the babies concerned being 4 and 10 ng/ml. If the babies had developed haemorrhagic disease of the newborn it would have been mandatory to say so; we thought it relevant to state that they did not. We agree that it would be of great interest to determine 'the minimum plasma concentration required' to prevent the disease but suggest that no ethical study could achieve this. At present the best guide we have is the normal adult plasma concentration of vitamin K₁ (0.1-0.7 ng/ml).³

Finally, we do not believe that cost is the main reason that prophylaxis is not given to every baby. Parents rightly question the need for an injection in their well babies, some seeing it as unnecessary medical interference, and it is not totally without risk.⁴ Many maternity units currently give intramuscular prophylaxis only to a minority of babies, those considered most at risk from the disease. We hope that our paper will encourage them to give prophylaxis orally to the remainder who would otherwise receive none.