LETTERS TO THE EDITOR

Tests for growth hormone secretion

SIR,—We were interested in the correspondence between Dr Addy and Professor Brook and Dr Hindmarsh on detecting organic illness through assessment of height velocity.[1 2] The question, however, is academic and their arguments theoretical since, as we have recently shown, the assessment of height velocity in individuals is so imprecise as to be clinically meaningless. There is effectively no correlation between successive velocities, so that a 12 month velocity cannot possibly identify anyone.[3 4]

The Wessex Growth Study provides a practical demonstration of the problem. Thirty (17%) of the original cohort of 174 school entrants below the third height centile had identifiable organic disease. Eighteen of these were monitored over a period of three years alongside a cohort of 78 short 'normal' children in whom all pathology had been excluded. The height velocity of four of the short 'normal' children and two of those with organic disease was deemed to be on or below the third centile for velocity after the first year. Over the next 12 months, two of the short 'normal' subjects, and three of those with organic disease, were growing at a rate below the third centile, but the identity of the 'poor growers' changed from year one to year two.

We should abandon the notion that low 12 month velocities will effectively identify pathology. The children in the Wessex Growth Study with organic causes of short stature were identified at the beginning of year one on the basis of height screening alone.

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1 Brook CGD, Hindmarsh PC. Tests for growth hormone secretion. *Arch Dis Child* 1991;**66**: 85–7.
2 Addy DP. Tests for growth hormone secretion. *Arch Dis Child* 1991;**66**:749.
3 Voss LD, Bailey BJR, Cumming K, Wilkin TJ, Betts PR. The reliability of height measurement. *Arch Dis Child* 1990;**65**:1340–4.
4 Voss LD, Wilkin TJ, Bailey BJR, Betts PR. The reliability of height and height velocity in the assessment of growth (the Wessex Growth Study). *Arch Dis Child* 1991;**66**:833–7.

The reliability of height and height velocity in the assessment of growth

SIR,—Voss *et al* make a good point when they emphasise the fact that height velocity is much worse affected by measurement error than height itself, partly because it involves two measurements both subject to error and partly because the normal variability of the error free quantity is much smaller.[1] But it is not clear that their conclusion follows, that velocity charts are no more discriminating than height charts in the screening context that they consider. To establish such a conclusion it would be necessary to have information not only on the normal children on which the charts are based but also on the abnormal children that the screening exercise is intended to detect.

Growth standard charts can be described as providing age specific normal ranges or reference values and their properties need to be assessed in terms such as sensitivity, specificity, and predictive values that are familiar in discussions of these topics. When only a single measurement is available it is usual to express it as a centile position on the height chart and to investigate the child if this position is below an arbitrary level, commonly the third centile. Such a procedure provides a protection against false positive errors; if applied to children from the normal population it ensures that not more than 3% of them will be unnecessarily investigated. It says nothing about the frequency with which children who are genuinely growth retarded will be missed by the screen. It is important to notice that the chart provides centiles for the *measured* height; the 'true' height of a child does not enter into the argument.

Exactly the same considerations apply to growth velocity. If children whose *measured* velocities fall below the third centile on the velocity chart are investigated, only 3% of those from the normal population will be included. Once again, the number of abnormal children picked up by such a screen is unknown, and once again the fact that a child's 'true' velocity may be rather far above (or below) its measured value is not to the point.

Only studies which include children known to be abnormal are capable of distinguishing between the properties of rival screening methodologies. It is natural to suppose that the two measurements included in a velocity are capable of providing more information than a single measurement; the question is whether the value of the extra information outweighs the delay which its acquisition involves.

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1 Voss LD, Wilkin TJ, Bailey BJR, Betts PR. The reliability of height and height velocity in the assessment of growth (the Wessex Growth Study). *Arch Dis Child* 1991;**66**:833–7.

Mr Bailey and Ms Voss comment:

Professor Healy is right to stress that velocity could, in some cases, be a useful discriminator in a screening context, but in our paper we were concerned mainly with the estimation of height velocities, and we showed that the imprecision attached to these estimations can be considerable. Unfortunately, disease specific growth charts are rare and more are needed. In the case of Turner's syndrome such a chart is available and the mean velocity is shown to be lower than normal.[1 2] If one were to screen for the disease by identifying all girls with a velocity less than the 3rd centile on the normal velocity chart, between the ages of 5–6 years, this would locate about 25% of girls with Turner's syndrome. On the other hand, screening for those below the 3rd centile for *height*, using the normal height chart at age 5 years, would pick out over 50% of these girls. (Actually, screening by height and then by velocity would be even better as girls with Turner's syndrome are on average shorter than normal and they also fall further behind with increasing age. As Professor Healy points out, however, the extra information gained may not be worth the delay involved.)

The problem of choosing an appropriate method of screening is further demonstrated by our letter in this issue regarding the comments of Dr Addy.[3] In this, we describe how children in the Wessex Growth Study with pathology could not be distinguished from healthy children by their velocity over a single 12 month period. Certainly much work is yet to be done, and data collected on a variety of organic diseases, before it is possible to evaluate rival screening methodologies.

1 Lyon AJ, Preece MA, Grant DB. Growth curve for girls with Turner's syndrome. *Arch Dis Child* 1985;**60**:932–5.
2 Ranke MB, Pfluger H, Rosendahl W, *et al.* Turner syndrome: spontaneous growth in 150 cases and review of literature. *Eur J Pediatr* 1983;**141**:81–8.
3 Addy DP. Tests for growth hormone secretion (letter). *Arch Dis Child* 1991;**66**:749.

Terbutaline powder in asthma exacerbations

SIR,—Inhaled β_2 agonists are the most efficient means of relieving acute bronchoconstriction in asthmatic children. However, inhalation technique with a metered dose inhaler is often unsatisfactory particularly in young dyspnoeic children. Spacers have been shown to be useful in this setting.[1 2] Asthmatic children may be reluctant to carry spacers during daily activities because they are cumbersome. The Turbuhaler (Astra, Turbohaler in the UK) is a new multidose breath actuated pure powder inhaler available for the administration of terbutaline. It can be triggered by an airflow of 22 l/min; this is reached by almost all children over 5 years old in a stable condition and even by those with moderately acute asthma.[3] Terbutaline given with a Turbuhaler is effective in the treatment of exercise induced asthma.[4] It has not been reported yet if terbutaline with Turbuhaler is effective in children with acute asthma.

Twenty two children attending the hospital with acute wheeze were included in an open, randomised, parallel group study comparing the efficacy of 0·5 mg of terbutaline given either with a Turbuhaler or with a metered dose inhaler attached to Nebuhaler (Astra). Administration of the drug was carefully supervised and consisted of one inhalation by the Turbuhaler or two consecutive puffs of terbutaline introduced separately by the Nebuhaler at one minute intervals as previously described.[1 3] Before, 15 and 30 minutes after treatment we measured specific airway resistance (sRaw in cm H_2O/l/s, body plethysmograph 2800, Physiosystem), forced expiratory

Results in efficacy of the two systems after inhaling 500 µg of terbutaline. Results are mean (SD)

Variable	*Nebuhaler*	*Turbuhaler*
sRaw (cm H_2O/l/s):		
Initial	14·1 (3·5)	13·5 (3·4)
15 Minutes	7·4 (2·0)	6·4 (1·6)
30 Minutes	6·5 (1·7)	6·4 (1·9)
FEV_1 (ml):		
Initial	1200 (390)	1610 (510)
15 Minutes	1530 (640)	1820 (610)
30 Minutes	1560 (600)	1830 (580)
PEFR (l/min):		
Initial	184 (47)	217 (74)
15 Minutes	214 (56)	265 (75)
30 Minutes	233 (54)	276 (85)