Is late walking a marker of morbidity?

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Abstract
We identified 410 infants who were not walking independently by the age of 18 months from among a geographically defined population of 4275 infants who either were born weighing less than 2000 g or had needed admission to the special care nursery in the neonatal period. The outcome of the late walkers was ascertained at the age of 3 years by health visitors using a standard questionnaire. Of the late walkers, 230 (56%) had an associated abnormality diagnosed before the age of 3 years, and in 77 of these children (33%) this was definite or suspected cerebral palsy. The high prevalence of late walking among infants born before 28 weeks' gestation (46%) was almost entirely accounted for by a high incidence of impairment. Late walking is a simple marker of morbidity in this group of infants.

Nearly every child (97%) can walk five steps independently by the age of 18 months.[1] Failure to achieve this milestone may be associated with neurological abnormality, or impairment in other systems, but in many late walkers there is no obvious cause. They could represent the limit of normal biological variation in the age of independent walking.

Infants who have been born preterm are at increased risk of delayed motor development,[2] and of motor impairment, particularly cerebral palsy.[3] It is therefore likely that they are over-represented among the late walkers.

We have studied the association between late walking, neurological and non-neurological abnormality, and gestational age at birth, to find out to what extent late walking can be used as a risk marker for impairment among low birthweight babies or in babies who have been ill during the neonatal period, and what the relative contributions are of 'biological immaturity' and impairment to late walking among babies born early in gestation.

Subjects and methods
We studied infants born in 1984 and 1985 whose mothers were resident in the Oxford health region at the time of delivery, and who either weighed less than 2000 g at birth, or were admitted to a special care nursery for more than 24 hours during the neonatal period. Those who survived were enrolled in the study. Eligible infants were identified by a weekly telephone call to each of the 10 special care nurseries in the region. Low birthweight infants born outside the region (to mothers normally resident in the region) were identified from birth registration data. Information on larger infants born outside the region who were in special care nurseries was obtained from health visitors.

We sought parents' permission to send the results of a number of routine screening tests done at 7–8 months and 18 months to the project office.[4]

As each infant approached the age of 7–8 months and 18 months (uncorrected for gestational age at birth), a form was sent to health visitors for completion at the time of assessment. The questions on the 18 month form included 'Is the child walking five steps independently?'

For all the late walkers and also for those whose ability to walk at 18 months of age was not known, we found out the outcome at the age of 3 years by sending a simple questionnaire to the health visitors of the children who were not walking requesting information about the eventual age of walking, and about any abnormality that had been diagnosed.

We classified the late walkers into one of six categories: cerebral palsy, other neurological disease, global delay, major congenital anomaly (not affecting the central nervous system), other diseases, and no detectable associated condition. If cerebral palsy was associated with other impairments, the child was classified as having cerebral palsy. Global delay was defined as delay in all fields of development.

The cases of cerebral palsy on a regional register of impairment in 3 year old children were used to assess the predictive ability of failure to walk at the age of 18 months for cerebral palsy.[5]

Results
A total of 4527 infants were eligible for entry into the study. Sixty one died between the time of discharge from the special care nursery and the age of 18 months.

The ability to walk at the age of 18 months was ascertained for 4275 of the remaining 4466 infants (96%). The mean (SD) birth weight (2584 (840) g) and mean gestational age (36·3 (3·5) weeks) of infants whose ability to walk was known were similar to those of babies whose ability was not known (birth weight 2611 (819) g, and gestational age 36·2 (3·3) weeks). At 18 months, 410 of 4275 of the children (10%) were not walking independently.

Abnormalities associated with late walking

	No of late walkers	Percentage of all late walkers
Cerebral palsy:	77	19
Definite	66	
Suspected	11	
Other neurological disease:	33	8
Hydrocephalus without neural tube defect	9	
Neural tube defect	5	
Microcephaly	6	
Associated epilepsy	8	
Developmental anomaly of brain	2	
Cytomegalovirus inclusion disease	1	
Acute alternating hemiplegic migraine	1	
Leigh's disease	1	
Global delay:		
Not associated with chromosome anomaly or syndrome	39	10
Associated with chromosome anomaly or syndrome	40	10
Other serious congenital anomalies not affective central nervous system:	19	5
Cardiac	10	
Orthopaedic	5	
Other	4	
Other:	22	5
Metabolic and endocrine	6	
Severe vision impairment	5	
Bronchopulmonary dysplasia	4	
Muscular dystrophy	2	
Not yet classified (for example, neoplasm, dysmorphic features)	5	
Late walkers:		
With associated abnormalities	230	56
With no associated abnormalities	180	44
Total	410	100

LATE WALKING AS AN INDICATOR OF RISK OF ABNORMALITY

An associated abnormality was found in 230 of 410 infants who walked late (56%) (table). Of the 230 children who walked late and had an associated impairment, 77 (34%) had a definite or tentative diagnosis of cerebral palsy. A further 33 (14%) had evidence of neurological dysfunction that had not been classified under the umbrella term of cerebral palsy. Seventy nine children had moderate to severe degrees of global delay, and just over half of these had associated chromosome anomalies or syndromes. Severe vision impairment (n=5), and chronic lung disease (n=4), reflect the particular vulnerability of this group of babies, which included all infants weighing less than 2000 g at birth. Primary muscular disease was rarely the underlying cause of late walking in this group.

LATE WALKING AS AN INDICATOR OF RISK OF CEREBRAL PALSY

A total of 78 children in the population studied were entered as definite cases of cerebral palsy on the Oxford region register of impairments. Of these, 66 (86%) were not walking at the age of 18 months. One child's ability to walk at 18 months was not known. Hence not walking at the age of 18 months as an indicator of cerebral palsy had a sensitivity of 86% and a specificity of 92%. The positive predictive value, however, was only 16%, reflecting the low incidence of the condition even in this group who were at particular risk of motor impairment.

ASSOCIATION BETWEEN GESTATIONAL AGE AT BIRTH AND LATE WALKING

The prevalence of late walking increased with decreasing gestational age at birth (fig 1). Figure 2 shows that the proportion of late walkers with associated abnormalities increased at both the lower and upper ends of the gestational age range. The increased prevalence of late walking among infants born earlier than 28 weeks' gestational age is almost entirely accounted for by the increased risk of impairment. The increase in the prevalence of late walking associated with abnormality at the upper end of the gestational age scale almost certainly reflects the characteristics of larger infants who required admission to a special care nursery. These include infants with congenital anomalies as well as infants with signs of neurological dysfunction.
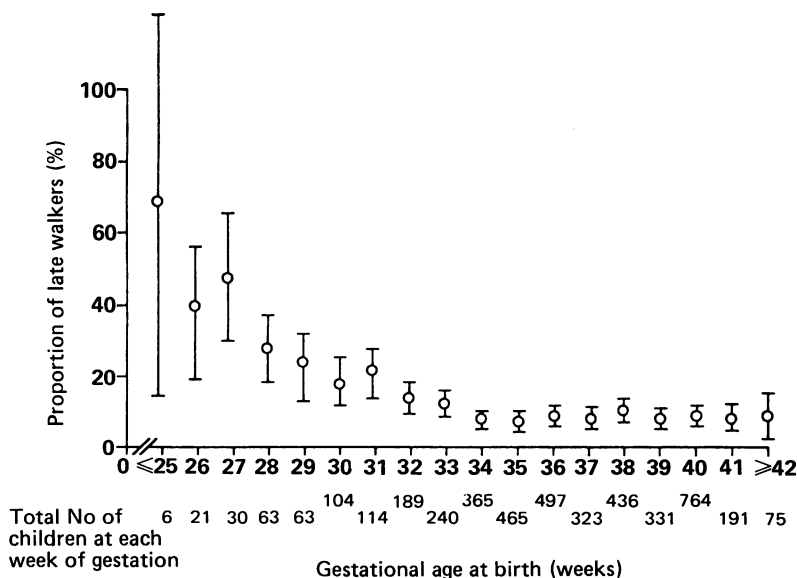

Figure 1 Percentage of children not walking at age 18 months by gestational age at birth (95% confidence intervals).
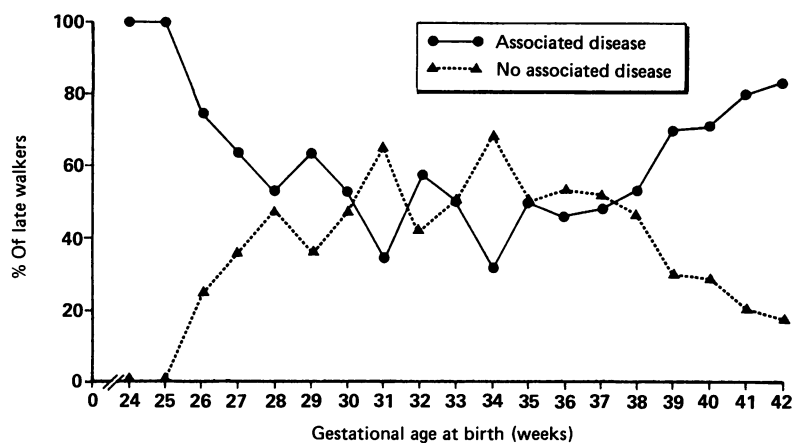
Total No of children at each week of gestation

0	≤25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	≥42
	6	21	30	63	63	104	114	189	240	365	465	497	323	436	331	764	191	75

Gestational age at birth (weeks)

Figure 2   Proportion of late walkers with and without associated diseases by gestational age at birth.

Discussion

Late walking seems to be a useful indicator of morbidity among certain infants who require special care in the neonatal period. Over half the infants who were late in walking had some associated abnormality, and they included 86% of the infants with cerebral palsy in this population.

Because many of the associated conditions had already been diagnosed by age 18 months, identification of late walkers cannot be regarded as a screening test. Previous studies have shown that few 'new' cases of cerebral palsy are detected by examining all infants who are late in walking.[6] For the clinician, however, late walking in this group is a useful indicator of infants who may require further investigation or continuing surveillance.

Among infants of low gestational age there is a tendency to regard late walking as part of the biological delay in achieving motor milestones as a result of immaturity. This is the basis of correcting for gestational age in longitudinal follow up studies of preterm infants. It has been suggested that this practice can be misleading and mask underlying impairment.[7] Our obser-

vations support this view, as in the lower gestational age range the associated impairments accounted for most of the late walking.

It has been suggested by the Joint Working Party on Child Health Surveillance, that routine developmental examination should be discontinued.[8] One of the observations underlying this recommendation is the difficulty of defining the limits of normality, and therefore of deciding who should be followed up. Although we welcome this reappraisal of development testing, we suggest that—rather than abandoning all developmental assessment—it is important to look within the vast range of developmental tests for key items that, either alone or in association, are reliable and can be regarded as markers of morbidity. Identification of such key items could be helpful to parents, provide guidelines for further referral and assessment, and monitor morbidity in large populations.

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