Gestational age – we do know what we are talking about, don't we?

Brian Darlow MD FRACP
Christchurch School of Medicine
University of Otago
Christchurch
New Zealand

Gestation is obviously key information during pregnancy: the fetus changes from non-viable to being capable of being born alive and surviving *ex-utero* during the second trimester; pregnancies that continue beyond 42 weeks became increasingly at risk of poor outcomes; and then there are all the social events that may be planned based upon the expected date of delivery (EDD). One of the earliest questions of any prospective parent is "when is my baby due". We like to think there is some certainty around the answer, but is there?

In veterinary practice things are generally pretty assured. In sheep, the oestrus cycle averages 17 days. Farmers know that after tupping, indicated on the ewe by the tell-tale chalk stain from the ram harness, the lamb drop can be expected 147 days later and will plan accordingly.

Human society is somewhat less regulated, thank goodness. But physiology is very different also. It is traditional to estimate the EDD, and therefore gestational age, from the first day of the last menstrual period (LMP) plus 280 days. However, there is clearly variation in the follicular phase of the menstrual cycle and implantation is a variable time from the LMP rather than an exact 14 days, and most commonly later rather than earlier than this. Only 5% of births occur precisely on the EDD. A further problem is that many women are known to have poor or erroneous recall of their LMP.

The LMP method measures the length of the pregnancy. Because of some imprecision, real or perceived, in this measure many other methods of estimating gestation have been considered [1]. Some of the most popular amongst paediatricians have been those based on physical and neurological examination such as the Dubowitz, Ballard and New Ballard scores. I well remember an older colleague who would regularly pronounce on the precise gestational age of a newly admitted infant after just one or two of his favourite elements of the Dubowitz score, even though the full score has an accuracy of around +/- two weeks, and ignoring the variance with the previously documented gestation. For a moderately preterm infant the key issues are essentially their physiological capabilities; sucking and swallowing, temperature control and presence or absence of apnoeic episodes rather than an "exact gestation".

The most common current method of assessing gestation is with antenatal ultrasound (US), which measures the size of the fetus. It is important to understand that most of the US dating formulae were developed using "reliable" LMP dates as the gold standard. If there are systematic errors in LMP dating, these will also be present in US dating [2,3]. Kalish et al [4] compared biometric (US) measurements and gestation based on *in vitro*

fertilization (IVF - day of ovum retrieval and fertilization plus 14 days). First trimester US (11 to 14 weeks) determined gestation to within 5 days but tended to slightly overestimate dates, whereas second trimester US (18 to 22 weeks) was within 7 days but tended to slightly underestimate dates.

In many highly developed countries there has been an increase in preterm births in recent decades. In the United States, for instance, the proportion of preterm births has risen from 9.5% in 1981, to 12.7% in 2004 [5]. (In the same period post-mature births declined from 7.5% to 2.6%.) Whilst several factors have contributed to the increase in preterm births, including artificial fertilization techniques and multiple births, indicated preterm deliveries, and increasing maternal age, Yang et al have shown that early US scanning has led to a left shift of gestational age estimates at delivery and this has "resulted in a substantial increase in preterm births" [6].

A further problem with US estimates of gestation is that there is no one universally agreed method for measuring the size of the fetus. Commonly used measures include head circumference (HC), bi-parietal diameter (BPD), crown-rump length (CRL) and femur length. The 2008 UK National Institute for Health and Clinical Excellence (NICE) guidelines on antenatal care [7] reviews the literature and recommends that CRL be used in the first trimester, but if CRL is >84 mm and in the second trimester HC should be used.

Many publications, in which gestation plays a key role, either do not define how gestation has been established or state that a "best estimate" has been used. There is frequently no or poor information as to whether one or another measure has been selected as correct or how different measures have been combined [8]. One method for combining LMP and early US is the "14-day rule", namely LMP is used unless there is a discrepancy between this and early US of >14 days when US would be used. But 10, 7, 5 and 3 day "rules" have also been used. The method chosen will affect gestation differently [9].

Although the result of using US rather than LMP has a much greater impact at gestations beyond 32 weeks, there are also a number of issues at very short gestations. "Amillia" was born at 21 weeks and 6 days, by "accurate dates", in Florida in 2006 and media reports suggested she was the most premature baby to have been given intensive care [10]. In fact, these dates were based on the timing of IVF and so equate to 23^6 or 24 weeks, which is by no means unusual. When counseling parents, or indeed making obstetric decisions, at short gestations we would certainly like to "know" an accurate gestation. Data from the ANZNN show that at very short gestations (22-25 weeks), survival increases by 2%-3% with each extra day *in utero* [11]. There is no magic line the fetus crosses when their chances of any, or intact, survival are suddenly greatly increased. Yet we talk about weeks gestation with quite different outcomes. In reality a baby of 24^1 weeks is much more like one of 23^6 than 24^6. Importantly, even if we do have accurate dates, other factors also have a large impact on outcome, particularly whether ante-natal steroids have been given, the sex and weight of the baby, whether this is a singleton or multiple birth and perhaps whether infection is present or not [12]. The "grey zone" around which discussions on approach to intensive care take place does not have clear margins[11].

Conclusions.

It would be helpful if clinical networks were able to reach consensus on guidelines for establishing gestation and managing discrepancies [13]. One proposal is that the standard should be that LMP is used, except that in the first trimester, if LMP and US estimates differ by >5 days, then the US estimate is used; in the second trimester, if LMP and US differ by >10 days, then US is used. Agreement should also be sought on which US measurements to use and here the NICE guidelines would seem to be a reasonable standard [7]. In addition, I would suggest there is a need for international consensus on how to report gestational age in publications. At the very least, all publications should state clearly how gestation has been estimated.

Gestation is a continuum and, at best, an estimate; there are no sudden "steps". At short gestations, each extra day *in utero* is of benefit in terms of physiological maturity. But whilst gestation is important at the grey zone of viability, many other things will affect both physiology and outcome – these include the infant's size and sex, whether antenatal steroids have been given, and the presence or absence of infection.

Clinicians should resist the urge to "alter" gestation to suit a particular mindset. I have noted a growing tendency for resident neonatal staff to undertake a modern version of the "Dubowitz reassignment" described above and revisit the baby's gestation if its size and apparent maturity do not match the obstetric dates. If, after careful consideration, it is felt the estimated gestation should be reassigned, the reasons for this should be clearly documented and the methodology used should be stated.

References

1. Anderson N, Wells E, Hay R, Darlow B. Cerebellar vermis measurement at cranial sonography for assessing gestational age in the newborn weighing less than 2000 grams. *Early Human Devel* 1996; 44: 59-70.
2. Alexander G, Tompkins ME, Petersen DJ, et al. Discordance between LMP-based and clinically estimated gestational age: implications for research, programs, and policy. *Pub Health Rep* 1995; 110: 395-402.
3. Lynch CD, Zhang J. The research implications of the selection of a gestastional age estimation method. *Paediatr Perinat Epidemiol* 2007; 21(S2): 86-96.
4. Kalish RB, Thaler HT, Chasen ST, et al. First- and second-trimester ultrasound assessment of gestational age. *Am J Obstet Gynecol* 2004; 191: 975-8.
5. Martin JA, Kochanek KD, Strobino DM, et al. Annual summary of vital statistics 2003. *Pediatrics* 2005; 115: 619-34.
6. Yang H, Kramer MS, Platt RW, et al. how does early ultrasound scan estimation of gestational age lead to higher rates of preterm birth? *Am J Obstet Gynecol* 2002; 186: 433-7.
7. National Collaborating Centre for Women's and Children's Health. Antenatal care: routine care for the healthy pregnant woman. RCOG, 2008 http://www.nice.org.uk/guidance/CG62

8. van Rijn RJ, de Beaufort AJ. Errant use of gestational age terminology to describe the duration of pregnancy. *E-PAS* 2006; 4850.228.
9. Blondel B, Morin I, Platt RW, et al. Algorithms for combining menstrual and ultrasound estimates of gestational age: consequences for rates of preterm and postterm birth. *BJOG* 2002; 109: 718-20.
10. "World's youngest baby born in Miami". http://www.justnews.com/news/11053141/detail.html
11. Darlow BA. The limits of perinatal viability: grappling with the "grey zone" (Editorial). *Med J Aus* 2006; 185: 477-9.
12. Tyson JE, Parikh NA, Langer J, et al. Intensive care for extreme prematurity – moving beyond gestational age. *N Engl J Med* 2008; 358: 1672-81.
13. ACOG Practice Bulletin. Clinical management guidelines for obstetricians-gynecologists: number 98. *Obstet Gynecol* 2008; 112: 951-62.

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