

Algorithm for Estimation of Gestational Age

Introduction

Gestational age of a pregnancy and newborn is an important determinant of maternal and newborn outcomes. It is important in determining the timing of interventions as well as the understanding of perinatal issues within centres and in making comparisons between centres and provinces / territories. With the introduction of ultrasound dating of pregnancies, numerous methods are now used in Canada for estimating gestational age. Fetal ultrasound dating has become increasingly available and now is sufficiently common in Canada to be helpful in estimating gestational age in maternal and newborn research studies as well as descriptive studies of maternal and newborn health and disease. To this end, there would be considerable advantage in having a consistent method for estimating gestational age using the date of conception (when known), date of last menstrual period, fetal ultrasound dating, physical examination of the infant shortly after birth and obstetric best estimate before delivery. The purpose of this document is to achieve consistency in estimating gestational age for databases across Canada through consensus so that a standardised algorithm is used for clinical purposes, research and comparison studies. Note that in some situations the term, “completed weeks”, is used and, in this algorithm, “completed weeks” should be regarded as a block of 7 days[§]. However, except for certainty levels 4, 5 and 6 below, all estimates of “Best Estimate” of gestational age are expressed in weeks and days. In developing the following algorithm as proposed, data would be recorded at the time of data entry and then a standard algorithm, using the best available evidence, would be applied to these data to give the “Best Estimate” of gestational age. Hopefully in the future, this will become the standard for estimating gestational age in Canada. *Suggested Citation: Algorithm for the Estimation of Gestational Age, Canadian Perinatal Surveillance System, 2010.*

Data To Be Recorded in All Pregnancies, Including the Documentation of Unknown Values

1. **Date of the last normal menstrual period**, when known (LMP)[‡].
 - a. Estimated date of delivery, commonly known as “EDC” = the date of the first day of the LMP ‘plus’ 280 days.
2. **Usual cycle length, when known**, is used to calculate the EDC corrected for cycle length (Estimated EDC).
 - a. Estimated EDC = EDC ‘plus’ (aver cycle length in days) ‘minus’ 28 days.
 - b. When not known, the Estimated EDC is based on the EDC without correction without correction for cycle length.
3. **Date of conception**, only if determined by artificial reproductive technology (ART) measurement, when available.
 - a. When correctly documented by ART, this provides the more reliable estimate of gestational age.
 - b. ART-EDC = (date of conception) ‘minus’ 14 days ‘plus’ 280 days.

- c. If the woman underwent *in vitro* fertilisation with embryo-transfer, then ART-EDC = (date of embryo-transfer) ‘**minus**’ (age of embryo at transfer) ‘**minus**’ 14 days ‘**plus**’ 280 days (see ref. 6).
4. **Date, type of ultrasound procedure (i.e., vaginal or trans-abdominal), and gestational age at the time of the first (earliest) fetal ultrasound examination.**
 - a. If the first fetal ultrasound was done before 8 completed weeks (based on LMP) and was not vaginal, then in addition record the first fetal ultrasound measurements of the fetus after 8 completed weeks (based on LMP).
 - b. If ultrasound exam was not done before 8 completed weeks, then record the first vaginal or trans-abdominal ultrasound measurements of the fetus between 8 and 24 completed weeks (based on LMP).
5. **Neonatal clinical estimate of gestational age** from neonatal physical exam done within 24 hours of birth and expressed in completed weeks (see refs. 1 and 9).
6. **Obstetric clinical estimate of gestational age** based on whatever clinical criteria are available before birth and expressed in completed weeks.

Algorithm for Deriving the “Best Estimate” of Gestational Age at Birth Depending on Which of the Above Recorded Information Is Known and Available

As the algorithm moves from certainty levels (algorithm steps) 1 to 6 below, increasingly less information is available and, as a consequence, the “Best Estimate” of gestational age is increasingly less reliable. The level of certainty, as indicated by the step in the algorithm used to determine the gestational age, should be recorded.

- Step 1:** When the Date of Conception is known and correctly documented by ART, the “Best Estimate” of gestational age is computed as the (date of birth) ‘**minus**’ (date of conception) ‘**plus**’ 14 days.
- a. If the individual underwent *in vitro* fertilisation with embryo-transfer, then the gestational age is computed as the (date of birth) ‘**minus**’ (date of embryo-transfer) ‘**plus**’ (age of the embryo at the time of transfer) ‘**plus**’ 14 days.
- Step 2:** If the date of conception is not by ART and if the early fetal ultrasound* and the Estimated EDC are available, the “Best Estimate” of gestational age is based on the LMP corrected for cycle length validated by the early fetal ultrasound dating, if:
- a.) at <14 completed weeks (based on LMP), the Estimated EDC is ≤ 5 days of that computed from the fetal ultrasound measurement,
 - b.) at 14 to 17 completed weeks (based on LMP), the Estimated EDC is ≤ 7 days of that computed from the fetal ultrasound measurement,

- c.) at 18 to 20 completed weeks (based on LMP), the Estimated EDC is \leq 10 days of that computed from the fetal ultrasound measurement, or
- d.) at 21 to 24 completed weeks (based on LMP), the Estimated EDC is \leq 14 days of that computed from the fetal ultrasound measurement.

Otherwise, the “Best Estimate” of gestational age below 25 completed weeks is based on that gestational age computed from the fetal ultrasound measurement alone. Ultrasound dating after 24 weeks is not useful for estimating gestational age.

In the case of multi-fetal pregnancies, the ultrasound measurement of the smaller fetus in one study was found to be more reflective of the gestational age of the pregnancy (see ref. 7). In conditions where fetal size is affected by the underlying disorder, such as hydrops fetalis, or where there are large differences in estimates of gestational age, ultrasound dating may not be appropriate.

- Step 3:** If early fetal ultrasound* is not available and if the gestational age based on the Estimated EDC is within 20 days of the clinical estimate of gestational age from the neonatal physical exam, then the gestational age at birth based on the LMP corrected for cycle length is the best estimate. However, if the gestational age based on the Estimated EDC is not within 20 days of that based on the neonatal physical exam, then the best estimate of gestational age is based on the clinical estimate of gestational age from the neonatal physical exam.
- Step 4:** If none of the above information is available and the estimate of gestational age by neonatal physical exam is known, then the “Best Estimate” is equal to neonatal clinical estimate of gestational age in completed weeks.
- Step 5:** If none of the above information is available and the obstetric clinical estimate of gestational age is known, then the “Best Estimate” is equal to the obstetric clinical estimate of gestational age in completed weeks.
- Step 6:** If none of the above information is available, then the estimate of gestational age is recorded as unknown.

- § For example, 40 completed weeks is a block of 7 days, 40 weeks 0 days to 40 weeks 6 days; less than 40 completed weeks is 39 weeks 6 days or less; and more than 40 completed weeks is 41 weeks 0 days or more.
- ‡ Date of the last normal menstrual period (LMP) is defined as the date of last menstrual period off hormonal contraception with at least 3 normal menstrual periods following discontinuation.
- * “Early fetal ultrasound” is defined as the first vaginal fetal ultrasound before 8 completed weeks (based on LMP) or, if not available, the first vaginal or trans-abdominal fetal ultrasound at 8 to 24 completed weeks (based on LMP).

References

1. Ballard JL, Khoury JC, Wedig K, Wang L, Eilers-Walsman BL, Lipp R. New Ballard Score, expanded to include extremely premature infants. *J Pediatr*. 1991 Sep;119(3):417-23.
2. Carey JC, Klebanoff MA, Hauth JC, Hillier SL, Thom EA, Ernest JM, Heine RP, Nugent RP, Fischer ML, Leveno KJ, Wapner R, Varner M. Metronidazole to prevent preterm delivery in pregnant women with asymptomatic bacterial vaginosis. National Institute of Child Health and Human Development Network of Maternal-Fetal Medicine Units. *N Engl J Med*. 2000 Feb 24;342(8):534-40.
3. Hadlock FP, Harrist RB, Shah YP, King DE, Park SK, Sharman RS. Estimating fetal age using multiple parameters: a prospective evaluation in a racially mixed population. *Am J Obstet Gynecol*. 1987 Apr;156(4):955-7.
4. Lynch CD, Zhang J. The research implications of the selection of a gestational age estimation method. *Paediatr Perinat Epidemiol*. 2007 Sep;21 Suppl 2:86-96. Review.
5. Morin I, Morin L, Zhang X, Platt RW, Blondel B, Bréart G, Usher R, Kramer MS. Determinants and consequences of discrepancies in menstrual and ultrasonographic gestational age estimates. *BJOG*. 2005 Feb;112(2):145-52.
6. Rouse DJ, Caritis SN, Peaceman AM, Sciscione A, Thom EA, Spong CY, Varner M, Malone F, Iams JD, Mercer BM, Thorp J, Sorokin Y, Carpenter M, Lo J, Ramin S, Harper M, Anderson G; National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network. A trial of 17 alpha-hydroxyprogesterone caproate to prevent prematurity in twins. *N Engl J Med*. 2007 Aug 2;357(5):454-61.
7. Salomon LJ, Cavicchioni O, Bernard JP, Duyme M, Ville Y. Growth discrepancy in twins in the first trimester of pregnancy. *Ultrasound Obstet Gynecol*. 2005 Oct;26(5):512-6.
8. Sladkevicius P, Saltvedt S, Almström H, Kublickas M, Grunewald C, Valentin L. Ultrasound dating at 12-14 weeks of gestation. A prospective cross-validation of established dating formulae in *in-vitro* fertilized pregnancies. *Ultrasound Obstet Gynecol*. 2005 Oct;26(5):504-11.
9. Usher R, McLean F, Scott KE. Judgment of fetal age. II. Clinical significance of gestational age and an objective method for its assessment. *Pediatr Clin North Am*. 1966 Aug;13(3):835-48.

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