Clinical question. For infants delivered at ≥ 34 weeks gestation (P), is delivery by elective c-section under regional anesthesia (I) in comparison to unassisted vertex vaginal deliveries (C) associated with an increased risk of requirement for intubation during resuscitation (O)?

Search strategy (including electronic databases searched).
Medline and Old Medline 1948 through October 2009
Embase and Embase Classic 1947 through Oct 2009
Cochrane Database for systematic reviews through 2009 4th quarter
Review of references from key articles
Limited to human studies
Included all related term

Search:
cesarean section or operative delivery or abdominal delivery and newborn and resuscitation 385
cesarean section and pediatrician 63
cesarean section and newborn and resuscitation 377
cesarean section and regional anesthesia 683
cesarean section and asphyxia neonatorum 410
cesarean section and newborn and intubation 355

Abstracts (or full articles if an abstract was not available) of pertinent titles were reviewed for relevance.

Full text versions of the articles were obtained and reviewed.

Citations of articles of interest were reviewed for potential additional material.

Five articles were included as relevant to the question and are abstracted and commented upon below. These studies (Annibale 1995 p 862, Atherton 2006 p 332, Gordon 2005 p 599, Jacob 1997 p 217, Parsons 1998 p 241) directly address the question with retrospective studies of populations or cohorts.

State inclusion and exclusion criteria
No animal studies; no abstract only publications; no comments or letters were considered. All human studies which included intubation as a measurable resuscitative measure were included.

Number of articles/sources meeting criteria for further review:
Five articles met criteria for further review Of these 5 all were LOE P3.
## Summary of evidence

### Evidence Supporting Clinical Question

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Level of evidence
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## Evidence Opposing Clinical Question

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Atherton 2006 P 332*  
Gordon 2005 P 599*  
Jacob 1997 P 217*  
Parsons 1998 P 241* |
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*Intubation is the outcome measure*
REVIEWER’S FINAL COMMENTS AND ASSESSMENT OF BENEFIT / RISK:

According to the current NRP guidelines, the **risk factors** which are associated with the need for neonatal resuscitation are:

**Antepartum factors:**
- Maternal diabetes, pregnancy-induced hypertension, chronic hypertension, fetal anemia or isoimmunization, previous fetal or neonatal death, bleeding in the second or third trimester, maternal infection, maternal cardiac, renal, pulmonary thyroid or neurologic disease, polyhydramnios, oligohydramnios, premature rupture of membranes, fetal hydrops, post-term gestation, multiple gestation, size-dates discrepancy, drug therapy, maternal substance abuse, fetal malformation or anomalies, diminished fetal activity, no prenatal care, age<16 or >35 years

**Intrapartum factors:**
- Emergency cesarean section, forceps or vacuum-assisted delivery, breech or other abnormal presentation, preterm labor, precipitous labor, chorioamnionitis, prolonged rupture of membranes, prolonged labor, prolonged second stage of labor, macrosomia, persistent fetal bradycardia, non-reassuring fetal heart rate patterns, use of general anesthesia, uterine hyperstimulation, maternal narcotics treatment, meconium-stained amniotic fluid, prolapsed cord, abruptio placenta, placenta previa, and significant intrapartum bleeding.

Yet quantification of the risk of many of these factors individually or in combination has not been done.

In current obstetric, pediatric, and neonatal systems of care, better prediction of the need for resuscitation skills is needed for both patient safety and the efficient use of appropriately skilled (and costly) healthcare personnel.

The literature review for the observed need for neonatal resuscitation for a particular situation: the delivery of a >= 34 week singleton vertex infant by elective Cesarean section to a woman under regional anesthesia who has no risk factors identified after screening, appears to be a set of circumstances which identify a risk for intubation at birth not different from spontaneous vaginal delivery.

Five studies directly addressed this question with the exception that NONE included the late preterm (34-36 wk) baby but were limited to terms (>=37 weeks) and to singletons. All five showed no statistically significant or clinically relevant increase in the need for intubation at birth in TERM singletons without antenatally identified risk factors delivered by cesarean section under maternal regional anesthesia compared to spontaneous vertex vaginal deliveries without identified risk factors. The effect of vertex or nonvertex presentation was addressed in only 2 studies: Gordon found the need for resuscitation higher in the breech compared to cephalic babies delivered by cesarean section, while Atherton’s paper showed no difference.

**Acknowledgements:**

**Citation List**


LOE P4  Good Quality

Smaller observational cohort study of deliveries in 2 hospitals. Intubation was required in 0 of 331 births after c/section under regional anesthesia and 12 of 10,671 unassisted spontaneous vaginal births.

**LOE P3 Good Quality**

Retrospective cohort  Supportive of prediction of rare need for resuscitation after elective cs section under spinal or epidural anesthesia (2/2918) compared to spontaneous vaginally delivered singletons at term (12/21,733) in births 1998-2003 in Tasmania


**LOE P3 Good Quality**

Supports the low risk of need for resuscitation interventions in elective C sections under regional anesthesia. Retrospective cohort 1990-2002 composed of term singleton infants delivered by C section out of 44,938 eligible deliveries.  Elective C sections under regional anesthesia - resuscitation in 8% (Not statistically sig. different from SVD infants); Elective C section under general anesthesia-33%; Emergency C section under regional anesthesia-14%; and Emergency C section under general anesthesia -43%


**LOE P3 Good Quality**

Subgroups of a larger study showed risk of 0.2 for intubation for ventilation and 0.5 for intubation for meconium-stained amniotic fluid vs risk of 0 for spontaneous vaginal delivery, a statistically nonsignificant difference


**LOE P3 Good Quality**

Supports prediction that for term pregnancies, elective C section under epidural is no higher risk for need for intubation than SVD. However, general anesthesia raised the risk multifold.