

Sudden Unexpected Postnatal Collapse

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Objectives

- Define Sudden Unexpected Postnatal Collapse (SUPC)
- Describe the incidence of SUPC
- Identify risk factors for SUPC
- Share strategies to prevent SUPC

Background

- Breastfeeding is beneficial to mothers and babies
 - Deaths of 823,000 children and 20,000 mothers could be averted through universal breastfeeding, along with economic savings of \$300 billion¹
- 1998: World Health Organization
 - Ten steps to successful breastfeeding²
- 2009: Baby-Friendly Hospital initiative³

1. Victora, Cesar G, et al. "Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect." *The Lancet* 387.10017 (2016): 475-490.
 2. World Health Organization. Evidence for the ten steps to successful breastfeeding. Geneva, Switzerland: World Health Organization; 1998. Available at: www.who.int/nutrition/publications/evidence_ten_step_eng.pdf
 3. World Health Organization. *UNICEF Baby-Friendly Hospital Initiative: revised, updated, and expanded for integrated care*. 2009. Available at: http://apps.who.int/iris/bitstream/10665/43593/1/9789241594967_eng.pdf

WHO: Ten Steps to Successful Breastfeeding



• <https://www.who.int/nutrition/bfhi/bfhi-poster-A2.pdf?ua=1>

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- <https://www.who.int/nutrition/bfhi/bfhi-poster-A2.pdf?ua=1>

AAP Baby Friendly Hospital Initiative 2009

- Routine procedures, including assessments and Apgar scores conducted while SSC is underway
- Delay procedures that are painful or require separation until after the first hours, including Vitamin K and ophthalmic prophylaxis

Baby-Friendly USA. Guidelines and evaluation criteria for facilities seeking Baby-Friendly designation. 2012. <https://www.babyfriendlyusa.org/get-started/the-guidelines-evaluation-criteria>

Outcome Data

- Breastfeeding rates increased from 58% to 87%, including an increase from 34% to 74% among African-American women, at Boston Medical Center.
- In China, exclusive breastfeeding rates rose from 10% to 47% in urban areas and doubled in rural areas.
- Breastfeeding rates grew from 47% to nearly 100% in Nicaragua.

Do you know the "Ten Steps to Successful Breastfeeding"? L. O'Keefe. 2010 <https://www.aappublications.org/content/31/2/28.2>

Skin to Skin Care (SSC)

- Maximize surface contact between mother and baby
- Initiated immediately after delivery with the intent to attempt breastfeeding before 30 minutes of age
- Should continue for 1 hour per WHO
- Benefits
 - Infants: stabilize the newborn body temperature and blood glucose levels and promote cardiorespiratory stability, decrease pain
 - Mothers: decrease maternal stress and reduce post-partum hemorrhage
- Oxytocin release

• Nimbalkar S, et al. J Perinatol. 2014;34(5):364-368. 11. • Moore ER, et al. Cochrane Database Syst Rev. 2012;5:CD000359.

• Moore ER, Anderson GC. J Midwifery Womens Health. 2007;52(2):110-125.

• Makris L, et al. Early Hum Dev. 2012;91(1):159-70. 23.

• Spitzer A, et al. Midwifery. 2013;31(1):110-117.

Rooming In

- Promoting mothers and babies to remain together 24 hours per day while in the hospital
- Mothers expected to be more involved with routine care, including feeding, holding and bathing
- Newborns remain with mothers unless there is a medical reason for separation for either mom or baby
- Benefits
 - Improves maternal bonding and allows mothers to be more involved in the routine care of their babies
 - Procedures and assessments are done in the mother's room, preferably while being held skin to skin
 - Improved patient satisfaction
 - More opportunities to support maternal-newborn interactions

Safety Concerns Regarding Immediate SSC

- Newborn requiring PPV
- Apgar scores less than 7 at 5 minutes
- Discontinuous observation of the mother-infant dyad
- Lack of education and skills among staff supporting the dyad
- Unfamiliarity with the potential risks of unsafe positioning

Feldman-Winter, Lori, Lay P. Goldsmith, and Task force on sudden infant death syndrome. "Safe sleep and skin-to-skin care in the neonatal period for healthy term newborns." Pediatrics 138.3 (2016): e20161889.

Sudden Unexpected Postnatal Collapse

- Spain: SUPC increased from 0.06 per 1000 live births to 0.74 per 1000 live births after the introduction of SSC
- Includes any condition resulting in temporary or permanent cessation of breathing, or cardiorespiratory failure in the term or near term infant in the immediate postnatal period
- Characterized by apnea, lethargy, pallor, bradycardia or cyanosis

• Rodriguez-Alarcón Gomez J, et al. *Progresos de Obstetricia y Ginecología* 2011; 54: 95-9. 25.
 • Rodriguez-Alarcón J. *Pediatrics* 2011; Available from URL: http://pediatrics.aappublications.org/content/127/4/e869/full/reply/pediatrics_el_51270

SUPC Definition: British Association of Perinatal Medicine

- Term or near term infant (> 35 weeks gestational age) meeting the following criteria
 1. Well at birth and with a normal 5 minute Apgar
 2. Suffers cardiorespiratory collapse unexpectedly to an extent that resuscitation with intermittent positive-pressure ventilation is required
 3. Collapses within the first 7 days of life
 4. Either dies, requires intensive care or suffers neonatal encephalopathy
- Other medical etiologies, such as congenital heart disease, metabolic disease and infection must be ruled out for SUPC to be diagnosed

WellChild. Guidelines for the Investigation of Newborn Infants Who Suffer a Sudden and Unexpected Postnatal Collapse in the First Week of Life: Recommendations from a Professional Group on Sudden Unexpected Postnatal Collapse, London, UK: WellChild; 2011.

Diagnostic Criteria for SUPC

- ≥ 37 weeks gestation at birth
- Apgar score ≥ 8 at 5 minutes of postnatal age
- Collapse within 12 hours of birth in hospital
- Required resuscitation after collapse with positive pressure ventilation
- Died or received ongoing intensive care

• Modified from Becher et al, 2012.

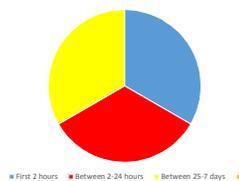
Rodriguez N, et al. *An Acute Event in a Newborn*. *Neoreviews* Vol. 18 No 12. December 1, 2017 pp. e717-e720.
 doi: [10.1542/neo.18.12.e717](https://doi.org/10.1542/neo.18.12.e717)

What is SUPC?

- <https://neoreviews.aappublications.org/content/18/12/e717>

- Rodriguez N, et al. *An Acute Event in a Newborn*. *Neoreviews* Vol. 18 No 12. December 1, 2017 pp. e717-e720. doi: [10.1542/neo.18-12-e717](https://doi.org/10.1542/neo.18-12-e717)

When does SUPC happen?



Rejovic NJ, Herliemus E. Unexpected collapse of healthy newborn infants: risk factors, supervision and hypothermia treatment. *Acta Paediatr*. 2013;102(7):680-688.

Incidence of SUPC

- 2.6-133 cases per 100,000 newborns
- Swedish Regional Study
 - First described in 1985
 - SUPC between 6-100 hours after birth
 - Neonatal unexpected death occurred at a rate of 12 per 1000,000 live births and severe early acute life threatening events occurred at a rate of 35 per 100,000 live births
- Germany and the UK both define SUPC as occurring in the first 24 hours, report an incidence of approximately 3 per 100,000 live births

Hilberger S, et al. *Acta Paediatr Scand*. 1985;74:861-6. doi: [10.1111/j.1651-2227.1985.tb01049.x](https://doi.org/10.1111/j.1651-2227.1985.tb01049.x).
 Poets A, et al. *Pediatrics*. 2011;127(6).

Incidence of SUPC

- Variability in definitions, inclusion and exclusion criteria and lack of standardized reporting
 - Gestational age > 35 or > 38 weeks
 - Onset of the event before 2, 12, 24 or 72 hours of postnatal life or within the first 7 days
 - Presence or absence of underlying conditions
- Underestimated incidence

SUPC vs. BRUE

- BRUE (Brief resolved unexplained event) or ALTE (apparent life threatening episode)
 - Brief, resolved unexplained event observed by a care giver in a child < 1 year of age with at least one of the following features:
 - Cyanosis or pallor
 - Absent, decreased or irregular breathing
 - Marked change in color
 - Altered responsiveness
 - Diagnosis made ONLY if no other explanation identified
 - Require minimal interventions such as positional changes, brief stimulation or procedures to resolve airway obstruction (suctioning)

Andres V, et al. Apparent life-threatening events in presumably healthy newborns during early skin-to-skin contact. Pediatrics. 2011;127(4)

SUPC vs. BRUE

- Low risk
 - > 60 days of age
 - ≥ 32 weeks gestation
 - PMA of > 45 weeks gestation
 - Absence of cardiopulmonary resuscitation
 - First time event that lasts < 1 minute
- Some overlap between SUPC and high risk BRUE

Pathophysiology of SUPC

- Before birth
 - High levels of neuromodulators, adenosine and prostaglandin, in the fetal brain
 - Cause inhibition of fetal movements, decreased metabolic rate and energy turnover (protects brain when oxygen and other resources are scarce during labor)
- After delivery
 - Continuous breathing pattern initiated after the first breath
 - Noradrenaline surge and high levels of catecholamines
 - Rapid decrease in adenosine in the brain as paO₂ increases -> increased newborn activity
 - Followed by period of decreased responsiveness to external stimuli and increased vagal tone

Pathophysiology of SUPC

- At birth
 - Hypoxia results in high levels of PGE₂ resulting in depression of brainstem respiratory center
 - Possibly contributing to postnatal irresponsiveness and results in SUPC within the first few hours of life

Presentations and Outcomes

- Retrospective analysis done of 398 published cases of SUPC
- Over half the infants died and the other half suffered severe neurological sequelae

Herfenius E, Kuhn P. Sudden unexpected postnatal collapse of newborn infants: a review of cases, definitions, risks, and preventive measures. Transl Stroke Res. 2013;4(2):236-247.

Triple Risk Hypothesis



Contributing Risk Factors

- Maternal
- Perinatal
- Neonatal
- Environmental

Herenius E, Kuhn P. Sudden unexpected postnatal collapse of newborn infants: a review of cases, definitions, risks, and preventive measures. *Transl Stroke Res.* 2013;4(2):236-247.

Maternal Risk Factors

- Primiparous status (75%)
- Maternal opiate analgesia
- Regional or general anesthesia within eight hours of event
- Magnesium sulfate administration during labor
- Body mass index > 25 kg/m²
- Maternal fatigue

Perinatal Risk Factors

- Delivery via cesarean section
- Prenatal compromise
- Passage of meconium in utero
- Need for extensive neonatal resuscitation

Neonatal Risk Factors

- Late preterm or early term infant
- Infant fatigue

Environmental Risk Factors

- First attempt at breastfeeding
- Unobserved skin to skin care with infant prone or side lying on mother's chest
- Mother in supine position during skin to skin contact
- Parental distraction
- Fatigued parents (29%)
- Mother left alone with neonate
- Low light environment
- Co-bedding with neonate

AAP Recommendations for Safe Sleep and Rooming In

- Infant positioning while skin to skin
- Recognition of maternal fatigue
- Increased monitoring by nursing in the first few hours after delivery
- Utilizing fall risk assessment tools
- Creating a risk stratification algorithm to identify the infants at highest risk for SUPC or falls

Feldman-Winter, L, Goldsmith, J. P., & Task force on sudden infant death syndrome. (2016). Safe sleep and skin-to-skin care in the neonatal period for healthy term newborns. *Pediatrics*, 138(3), e20161889

Box 2: Components of Safe Positioning for the Newborn While Skin-to-Skin¹⁰

1. Infant's face can be seen
2. Infant's head is in "sniffing" position
3. Infant's nose and mouth are not covered
4. Infant's head is turned to 1 side
5. Infant's neck is straight, not bent
6. Infant's shoulders and chest face mother
7. Infant's legs are flexed
8. Infant's back is covered with blankets
9. Mother-infant dyad is monitored continuously by staff in the delivery environment and regularly on the postpartum unit
10. When mother wants to sleep, infant is placed in bassinet or with another support person who is awake and alert

1. Ledington-Hoe Sim MK, Morgan K. Infant assessment and reduction of sudden unexpected postnatal collapse risk during skin-to-skin contact. *Newborn Infant Nurs Rev*. 2014;14(1):28-33

New Zealand Ministry of Health Guideline: Observation of mother and baby in the immediate postnatal period

- "All mothers and their babies must receive active and ongoing assessment in the immediate postnatal period, regardless of the context around their birth. During this time, the mother and baby should not be left alone – even for a short time."
- Ongoing assessment is for a minimum of one hour, then transfer observation of infant to mother/support person
- Promotion of skin-to-skin contact, and support and oversight of the first breastfeed
- Education on safe sleep
- District health boards and employers must ensure adequate staff
- **29% decrease in post-perinatal mortality**

<https://www.health.govt.nz/system/files/documents/publications/observation-mother-baby-immediate-postnatal-period-consensus-statements.pdf>

What about continuous pulse oximetry?

- No evidence that it improves safety, although standard in Japan
- Impractical???



<https://news.northwestern.edu/stories/2019/02/wireless-body-sensors-premature-babies-nicu>

Investigation of SUPC cases

- Structured investigations to determine the underlying cause
- Guidelines for the investigation of newborn infants who suffer and unexpected postnatal collapse in the first week of life
- Published by NHS in the UK

Recommendations for preventing SUPC

- Education for nursing staff
- Education for parents
- Checklists
- Schedule to monitor infants 0-3 hours after delivery
- Observation of first breast feeding attempt
- Reducing risks of distractions

Recommendations for preventing SUPC

- Education for nursing on:
 - Risk of bed-sharing
 - Avoidance of potentially suffocating infant positions (mouth/nose obstruction)
 - Need for adequate supervision of infant in the first few hours of life including periodical assessments
 - Encouragement of skin to skin care only when mothers are fully awake
 - Avoidance of mothers being left alone with the baby in the first few hours after birth, particularly during the first breastfeeding attempt and in primigravidas

Davanzo R, et al. (2015). Making the first days of life safer: preventing sudden unexpected postnatal collapse while promoting breastfeeding. *Journal of Human Lactation*, 31(1), 47-52.

Figure 1. Checklist for newborns 0-6 months of age, Particularity during the first 24 hours

Checklist Item	Yes	No	Not Done	Not Applicable
1. Infant positioned on visible and unobstructed head and nose				
2. 1794 under infant under mattress or crib				
3. Head of baby lying on mattress or ground or floor of the room				
4. Head of baby lying on bed or couch				
5. Head of baby lying on sofa or chair				
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Nursing guideline for closer monitoring of high risk infants

Davanzo, R., Travan, L., Verardi, G., Corubolo, E., De Cunto, A., Paviotti, G. & Cousin, E. (2014, December). Preventing sudden unexpected postnatal collapse in term and late preterm newborn infants: a surveillance protocol. *Italian journal of pediatrics* (Vol. 40, No. 52, p. A5). BioMed Central

RAPP Assessment Tool

- Simplified rapid assessment of newborns post-delivery which incorporates safe positioning
- R = Respiratory
- A = Activity
- P = Perfusion
- P = Position

Ludington-Hoe, Susan M., and Kathy Morgan. "Infant assessment and reduction of sudden unexpected postnatal collapse risk during skin-to-skin contact." *Newborn and Infant Nursing Reviews* 14.1 (2014): 28-33.

Checklist Item	Yes	No	Not Done	Not Applicable
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• RAPP Assessment Tool

K. Morgan. The RAPP Assessment: The 5th Annual National Intensive Neonatal Care Certification Course Manual. United States Institute for Neonatal Care, Cleveland, OH (2012), pp. 289-304

Figure 1. The RAPP Assessment. Any markings in the "shaded areas" are undesirable findings and require action by RN. * RN actions could be: repositioned head/neck, uncovered mouth/nose (infant awake), removed head covering (NID for awake), etc. ** Calculate the minutes of time infant spent in SSC and record here. (©) K. Morgan, 2013.

Recommendations for preventing SUPC

- If multiple risk factors present, AAP has recommended that babies should be monitored by hospital employee or electronically if someone is not available
- Associated increase in personnel costs
- Impinging on privacy
- Education for parents
 - Safe sleep practices
 - Proper positioning of the infant to maintain airway patency
 - Distraction free breastfeeding and skin to skin contact
 - Recognition of maternal fatigue
 - Utilization of bassinets that swivel towards the mother's bed

Future directions...

- Standardization of the definition
- Creation of evidence-based guideline