Emergency Cardiovascular Care and Resuscitation

*Ethical Aspects: What would you do?*

Sue Sreedhar, MD
*Cleveland Clinic Children’s Hospital*

Rajit K. Basu, MD MMI
*Cincinnati Children’s Hospital Medical Center*

FINANCIAL DISCLOSURE:
No relevant financial relationship exists

---

Real Disclosures

- Sue Sreedhar
  - Jack of all trades i.e. pediatric critical care
- Raj Basu
  - Amateur ethicist, professional realist, eternal optimist
Objectives

• Ethical Principles of Resuscitation
• eCPR and in-hospital cardiac arrest
• Neonatal Patients and Limitations of Resuscitation
• Data and Resuscitation Decision Making
• Organ Donation
Autonomy – a “missing” problem

• Children - incompetent, guardians make HC decisions
• Guardian has decision-making capability unless incapacitated or declared incompetent by court of law
• Decisions made by MD and legal guardians together to achieve patients’ GOC
• Minors < 18 years in US rarely have legal authority to consent except under pre-defined situations
  – Mature Minor
  – Medical Emancipation – Married or Military service

Initiation of Resuscitation

• Ethical, legal, cultural factors influence decisions
• Decisions guided by science, surrogate preferences, local policies, legal requirements, and established ethical principles
• A rescuer may not know the victim, GOC, or AD
• CPR may be contrary to the individual’s GOC
• When GOC are unknown or uncertain, it is ethically appropriate to treat emergency conditions until further information is available
DNR, DNAR, AND, DDNR, Portable DNR

- Clearly written out-of-hospital DNAR orders, wallet ID cards, ID bracelets, forms approved by local EMS
- Ideal document is portable
- When not clear, resuscitate
- Self-reported pseudo-CPR by paramedics in 27% of CA when cessation of CPR orders were not in place
- Token effort “slow-codes” compromises ethical integrity, creates a false impression, undermines relationship

Sherbino J, Prehospital emergency medical services. CJEM. 2000;2:246–251

Terminating Resuscitation

Outside hospital cardiac arrest

- Provide treatment unless clear facts on code status
- Withhold:
  - Signs of irreversible death (rigor mortis, dependent lividity, decapitation, transection, decomposition)
  - A valid AD, POLST, DDNR, Portable DNR, ID bracelet, pocket ID card approved by local EMS
  - If performing CPR would place rescuer at risk of serious risk (injury or infections)
- In absence of these for neonatal/pediatric OHCA, pre-hospital provider should resuscitate and consult with real-time medical direction or transport child to most appropriate facility
Infants and children with OHCA

- Intra-arrest prognostic factors for poor outcome
  - Age < 1 year
  - Longer duration of cardiac arrest
  - Non-shockable as opposed to a shockable rhythm
- Multiple variables to prognosticate, no single factor predicts outcome with accuracy to recommend termination or continuation of CPR

Objectives

- Ethical Principles of Resuscitation
- eCPR and in-hospital cardiac arrest
- Neonatal Patients and Limitations of Resuscitation
- Data and Resuscitation Decision Making
- Organ Donation
eCPR for IHCA

- Rapid deployment ECMO as rescue during CPR
- Gives time for those with reversible heart disease or transplantation
- Arrest occurs in highly supervised environment - ICU with clinical protocols, expertise, equipment
- Can serve as a bridge for LVAD
- Survival to hospital discharge 34% to 51%


---

eCPR for IHCA

- Insufficient evidence to recommend routine use
- Plenty of adult observational studies for eCPR
- Infants/children in IHCA
  - Standard resuscitation vs standard resuscitation + ECMO showed little evidence of benefit
  - However, outcome of some patients, such as those with underlying heart disease, may be improved

Wu ET, Resuscitation, 2009; Moler, CCM, 2009; Lowry, Pediatr Cardiol 2013
In Hospital Cardiac Arrests
Withdrawal and Withholding

• Limitations of care and WLST
• Not initiating resuscitation and discontinuing LST for IHCA during or after resuscitation are ethically equivalent
• Clinicians should not hesitate to withdraw support on ethical grounds when functional survival is highly unlikely

Terminating Efforts in Pediatric In-Hospital Cardiac Arrest

• For infants and children with IHCA, negative predictive factors include
  – Age of > 1 year
  – Longer durations of CA
• Evidence is contradictory as to whether a nonshockable (as opposed to shockable) initial cardiac arrest rhythm is a negative predictive factor in the in-hospital setting
Objectives

- Ethical Principles of Resuscitation
- eCPR and in-hospital cardiac arrest
- Neonatal Patients and Limitations of Resuscitation
- Data and Resuscitation Decision Making
- Organ donation

CPR in Neonates

*In Hospital Cardiac Arrest*

- In a NB with no HR, it is appropriate to stop resuscitation if HR is undetectable for 10 minutes
- Resuscitation after 10 minutes with no HR should take into consideration the etiology, gestational age, complications, parents’ opinion on risk of morbidity
- In absence of clinical decision rules to guide termination of resuscitation in NB, clinician should stop resuscitative attempt if lack of response is a certainty
CPR in Neonates

*In Hospital Cardiac Arrest*

- Management of NB at margins of viability, high risk of mortality or morbidity showed variation in attitudes and practice by region and availability of resources
- Parents desire a larger role in decisions to initiation of resuscitation and continuation of support of severely compromised newborns
- Under circumstances when the outcome remains unclear, desires of parents should be supported


Terminating Resuscitation in Neonates

*Recommendations*

- Apgar score of 0 at 10 minutes - strong predictor of M & M in late preterm and term infants
- If after 10 minutes of resuscitation, Apgar score and HR remain 0, it may be reasonable to stop assisted ventilation
- To continue or stop CPR must be individualized. Variables to be considered include
  - Whether the resuscitation was considered optimal
  - Availability of advanced neonatal care, such as TTM
  - Wishes expressed by family
Prognostic Score in DR for Preterm Infants

- Antenatal assessment of prognosis for survival/disability have been developed to improve prognostic accuracy
  - Gestational age alone
  - Gender
  - Use of maternal antenatal steroids
  - Multiplicity
- No evidence to support prospective use of DR prognostic score over gestational age assessment alone, in preterm infants < 25 weeks of gestation

Prognostic Score in DR for Preterm Infants

- No score has shown to improve clinician’s ability to estimate likelihood of survival 18 to 22 months after birth
- When counseling a family and constructing a prognosis for survival at gestation < 25 weeks, consider variables such as accuracy of gestational age, presence or absence of chorioamnionitis, and level of care available at location of delivery

Mancini ME et al, Circulation. 2015;132[suppl 2]:S383–S396
Objectives

• Ethical Principles of Resuscitation
• eCPR and in-hospital cardiac arrest
• Neonatal Patients and Limitations of Resuscitation
• Data and Resuscitation Decision Making
• Organ donation

Decision Making: Prognostication

• Multiple variables can be used
• No single factor studied predicts outcome with sufficient accuracy to recommend termination or prolongation of CPR
Timing of Prognostication

Targeted Temperature Considerations

• 72 hrs after arrest without TTM
• With TTM
  – Can be longer if residual drugs confounds exam
  – Usually 4.5 to 5 days after ROSC
  – WLST may occur appropriately before 72 hours because of underlying terminal disease, brain herniation, or other clearly non-survivable situations

Clinical Examination Findings

• No pupillary reflex at > 72 hours → poor CNS outcome
• Motor and myoclonus
• Absent motor movements, extensor posturing should not be used alone to predict poor neurologic outcome
  – Motor exam is to identify those who need prognostic testing to predict poor outcome
  – Myoclonus should be used in combination with other diagnostic tests at > 72 hours after CA

Imaging Tests

• Poor Outcome
  – Brain CT: ↓ ↓ gray-white ratio within 2 hrs
  – Brain MRI: Restriction of diffusion at 2 to 6 days

• Due to inter-observer variability, brain imaging studies for prognostication should be performed only in centers where specific experience is available

Data During Resuscitation

Neurologic Prognostication

• Early prognostication of neurologic outcome
  – Helpful for planning and family support and for informed decisions
  – Greater neuroplasticity - potential for recovery in a developing brain
  – Decision to WLST is complex, rests with the treating MD and family

• 2 small pediatric observational studies:
  – Continuous, reactive tracing on EEG done in 1st 7 days after CA showed higher likelihood of good CNS outcome at hospital discharge
  – Discontinuous or isoelectric tracing was associated with a poorer neurologic outcome at hospital discharge

• SSEP - sedative drugs or temperature manipulation do not affect SSEPs like they affect the EEG and clinical examination
EEG findings

- **Continuous** - GOOD

Prognostication - Labs

- **ETCO₂** < 10 mm Hg immediately after intubation and 20 minutes of CPR → poor outcomes
- **Biomarkers**
  - Lactate
    - Low → improved outcomes (limited data)
  - Neuron-specific enolase (NSE) and S-100B serum
    - NSE and S-100B are not specific to neuronal damage, produced by extra–CNS sources (hemolysis, neuroendocrine tumors, myenteric plexus, muscle and adipose tissue breakdown)
    - Low levels post-arrest → better outcome
    - High serum NSE at 48 to 72 hours → poor outcome
Objectives

• Ethical Principles of Resuscitation
• eCPR and in-hospital cardiac arrest
• Neonatal Patients and Limitations of Resuscitation
• Data and Resuscitation Decision Making
  • Organ donation

Ethics of Organ and Tissue Donation

• Situations that offer opportunity for organ donation
  – Neurologic determination of death (brain death)
  – Controlled donation after circulatory determination of death in a patient whose advanced directives or surrogate family, and medical team agree to allow natural death and withdraw life support (DCD)
  – Uncontrolled donation after circulatory determination of death after resuscitative efforts in the ED have failed to ROSC (cardiac death)
Ethics of Organ and Tissue Donation

• All patients progressing to death or brain death should be evaluated for organ donation
• Those with no ROSC after resuscitation efforts and who those with termination of efforts may be considered candidates for kidney or liver donation in settings where programs exist
• Decisions for termination of resuscitative efforts and the pursuit of organ donation need to be independent processes

PICU - Mode of death not different
Requests for organ donation varied across sites

• 275 pts died in hospital; 92% died in PICU
• Discussion with families on limitation or WLST during PICU stay for 63% who died
• Mode of death did not differ across sites:
  – WLST 51%
  – Failed CPR 19%
  – Limitation of support 17%
  – Brain death in 13%
• Organ donation requested from 37%; of those 20% donated
• Most deaths in CPCCRN-affiliated PICUs occur after limiting or WLST. Wide practice variation exists in requests for organ donation and autopsy
Take Home Message

- Resuscitation is a synchronized team effort
- Moral distress from
  - Lack of understanding of the big picture
  - Suboptimal team leadership
  - Experiences with variable meanings to “resuscitation”
  - Experiences with uncertainty of role responsibility

Thomas, T, Pediatr Crit Care Med 2016

Abbreviation Codex

- GOC = goals of care
- HC = health care
- DNAR = do not allow resuscitation
- AND = allow natural death
- DDNR = durable DNR
- OHCA = outside hospital cardiac arrest
- POLST = physicians orders for life sustaining treatment
- ECMO for refractory CPR = eCPR
- TTM = targeted temperature management
- IHCA = in hospital cardiac arrest
- CA = cardiac arrest
- WLST = withdrawal of life sustaining treatment
- NB = newborn
- HR = heart rate
- DR = delivery room
- DCD = donation after cardiac death
- SSEP