**Cardiac Resuscitation-CLEAR**

**What is the clinical benefit or outcome?**
The goal of cardiopulmonary resuscitation is to revive someone who is not breathing and without a pulse. Although the goal would be to return the person to their previous state of health, there are two other outcomes that are more likely even after an initial successful resuscitation that restores breathing and a pulse. The first outcome is death prior to hospital discharge. The second outcome is significantly worse, permanent neurologic function. Regardless of site of care or age, the most likely outcome is that the initial resuscitation is not successful.

**What is the efficacy?**
Although there is some decline in efficacy due to age alone, other factors are more important. These include the location of the arrest, whether or not it is witnessed, the presenting rhythm, the time to defibrillation and the baseline functional status of the person. So for example, resuscitating ventricular fibrillation is still very effective in older adults whereas resuscitating asystole is largely ineffective in any adult. By decade, success probably declines by a few percentage points. (16, 25)

<table>
<thead>
<tr>
<th>Site of CPR</th>
<th>Does not survive code</th>
<th>Death in hospital</th>
<th>Alive to hospital discharge</th>
<th>Survival to d/c with good neuro outcomes</th>
<th>Survival at 1 year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inpatient (geriatric specific data)</td>
<td><strong>50</strong>&lt;sup&gt;(1)&lt;/sup&gt;</td>
<td>32</td>
<td>18&lt;sup&gt;(2)&lt;/sup&gt;</td>
<td><strong>8-14</strong>&lt;sup&gt;(3,4)&lt;/sup&gt;</td>
<td><strong>5-8</strong></td>
</tr>
<tr>
<td>Outpatient (5)</td>
<td>77</td>
<td>15</td>
<td>8</td>
<td>3&lt;sup&gt;(6)&lt;/sup&gt;</td>
<td>?</td>
</tr>
<tr>
<td>Nursing home (7)</td>
<td>80-100</td>
<td>10-20</td>
<td>0-7</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

For every patient with good outcome

<table>
<thead>
<tr>
<th>Site of CPR</th>
<th>Good Outcome</th>
<th>Prolonged death/significantly worse neuro status</th>
<th>Does not survive code (or pronounced in ED)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inpt</td>
<td>1</td>
<td>3-4</td>
<td>5-6</td>
</tr>
<tr>
<td>Outpatient</td>
<td>1</td>
<td>8</td>
<td>25</td>
</tr>
<tr>
<td>NH</td>
<td>1 (or 0)</td>
<td>3-4 (vs infinity)</td>
<td>50 (to infinity)</td>
</tr>
</tbody>
</table>

For nursing homes, 2 studies had 0%, 1 had 2% and two had 5-11%. For the NH with the 11% success rate, ⅓ of patients were pronounced dead at the NH and not included in final outcomes.
Numbers may be very different for those with Class IV heart failure, metastatic cancer, ESRD etc.

**What are the potential adverse effects?**

1. A prolonged death by a means other than arrhythmia to something that may cause more suffering. In outpatient cardiac arrests, for every patient discharged alive, 3 will be successfully resuscitated and admitted but die during the hospitalization due to complications of anoxic encephalopathy. These include respiratory failure (59%), or cardiogenic shock (31%), and less commonly, another arrhythmia (10%). (17).

For every successful inpatient cardiac resuscitation who is discharged alive, there will be two patients who will be successfully resuscitated but die during the hospitalization.

2. Traumatic complications of cardiac resuscitation.
Of survivors, about 31% will have rib fractures, 21% will have a sternal fracture, 18% will have mediastinal hemorrhage, 20.4% will have upper airway damage, 30% will have visceral complications including gastric distention and liver or splenic lacerations (19).
3. Living with a permanent, significantly worse neurological status. Outcomes in older adults vary widely from good neurological outcomes that are as high as 80% of survivors to outcomes where 50% are in vegetative states. For outpatients, good neurological outcomes can occur from about 2% of all resuscitations to up to 20% of bystander witnessed vfib arrests. (Good outcomes: 7, 23, 20, 22, 21. Bad: 3, 4, 24, 6.)

For inpatient cardiac arrest, about 40-80% who survive will have a neurological status similar to their baseline. The other half will be in a vegetative state or severely neurologically impaired and may need institutionalization.

**What is the relevance to goals of care?**

The aim of having end of life discussions is not necessarily to make all older adults DNR but to make sure the choice selected realistically matches their goals.

<table>
<thead>
<tr>
<th>Goal</th>
<th>CPR</th>
<th>No CPR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longevity</td>
<td>Longevity is still a goal</td>
<td>Longevity is no longer a goal</td>
</tr>
<tr>
<td></td>
<td>Dying peacefully is not a goal</td>
<td>Dying peacefully or naturally is a goal</td>
</tr>
<tr>
<td></td>
<td>Avoiding a prolonged death is not a goal</td>
<td>Avoiding a prolonged death is a goal</td>
</tr>
<tr>
<td>Comfort</td>
<td>Not a primary goal</td>
<td>Comfort is a primary goal</td>
</tr>
<tr>
<td>Function</td>
<td>Low functional requisite for living</td>
<td>High functional requisite for living</td>
</tr>
<tr>
<td>Pain tolerance</td>
<td>High tolerance for trauma</td>
<td>Low tolerance for pain and trauma</td>
</tr>
<tr>
<td>Risk Tolerance</td>
<td>A bad outcome would be okay because at</td>
<td>A bad outcome means the intervention</td>
</tr>
<tr>
<td></td>
<td>least an attempt was made for longevity</td>
<td>was not worth it.</td>
</tr>
</tbody>
</table>

CPR is a good choice for those who care about longevity more than dying peacefully or being comfortable AND are willing to accept the trauma of CPR AND and are accepting that they are much more likely to have a prolonged death from CHF or respiratory failure AND are okay with surviving with a very impaired neurological status AND understand that a poor neurological status is much more likely than surviving with a good neurological status.

CPR is a bad choice for someone who cares about dying peacefully OR who cares mainly about comfort, OR who has a low pain tolerance OR or would not want to expose themselves to the risk of having a prolonged death OR surviving with a worse neurological status.

REMEMBER: The decision regarding CPR is a separate issue from the aggressiveness of care someone would want while they are still alive. Someone may want to be in the ICU for their pneumonia but if they were found dead, they would want to be left in peace. DNR does not mean comfort care.
1. Outcomes
Evidence has to be collated from many sources. Some target return of spontaneous circulation (ROSC),
others look at survival to discharge, survival with good neurological outcomes, or even 1 year post discharge
survival and place of residence. CPR outcomes vary considerably by where it occurs.

A. Inpatient outcomes
The main study on inpatient outcomes comes from a national database called the National Registry for
Cardiopulmonary resuscitation. It is an observational database. Consequently, sicker patients who choose to
be DNR are not included (good thing). Therefore survival rates are likely higher than your average patient. In
other words, there is a selection bias (people who choose to be full code). It is a national study that is very
diverse (rural/urban, community/academic etc).

Four key studies have come out of this (many more)
Larkin. Resuscitation. 2010 (14). This was a publishing of medical diagnosis related to success. 49,130
patients. Shows how age, comorbidities, place of CPR in the hospital affect outcomes.
Goldberger. Lancet. 2012. (15). This is also from the same database looking at all adults who underwent
CPR in the hospital setting. It specifically looks at duration of CPR and how that affects outcomes finding that
while most survivors have CPR for less than 30 minutes, some who are coded longer than 30 minutes survive
with good neurological outcomes at approximately the same percentage (80%).
Ehlenbach. NEJM. 2009. (2). Again from the same database, this looked at all medicare enrollees who
underwent CPR. This is the definitive study for outcomes of hospitalized older adults.
Abbo. JAGS 2013 (1). This study looked at older adults who had inpatient CPR by where they came from (Home
vs NH) and by functional status.

B. Outpatient outcomes
Boyd. Emergency Medicine Clinics of North America. February 2012. (16). This is a good review article on
outpatient outcomes, factors related to survival and an evidence review.
Cardiovasc Qual Outcomes. 2010. (5). This is a systematic review and meta-analysis of all outpatient studies
on CPR. Data were extracted from 79 studies involving 142,740 patients.

C. Nursing home outcomes (7-13)
There are no key studies. There are many small observational studies based at a specific nursing home or
city. These studies have been done over decades during which the nature of nursing home patients have
changed dramatically. It is unclear if any of the data is truly applicable now.

D. Caveats to outcomes
<table>
<thead>
<tr>
<th>Age</th>
<th>Survival Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-39 years</td>
<td>13.6%</td>
</tr>
<tr>
<td>40-59</td>
<td>19%</td>
</tr>
<tr>
<td>60-79</td>
<td>16.9%</td>
</tr>
<tr>
<td>80+</td>
<td>10.9%</td>
</tr>
</tbody>
</table>

Age is not the most important predictor of survival. Place in hospital, initial rhythm, time to first shock,
admitting diagnosis etc play a much more important role. Younger people do poorly because cardiac arrest is
either unexpected or due to trauma.
Days in hosp before CPR | Preserved functional status | Worse functional status
---|---|---
0-3 days | 69% | 31%
>4 days | 40% | 60%

Once someone has been in the hospital for more than 3 days, the ratio of surviving with a good neurological status compared to surviving with a worse neurological status flips from favorable to unfavorable.

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Survival rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepatic Insufficiency</td>
<td>7.3%</td>
</tr>
<tr>
<td>Sepsis</td>
<td>7.6%</td>
</tr>
<tr>
<td>Metastatic Cancer</td>
<td>7.8%</td>
</tr>
<tr>
<td>Coma</td>
<td>8.2%</td>
</tr>
<tr>
<td>Trauma</td>
<td>9.7%</td>
</tr>
<tr>
<td>Acute CVA</td>
<td>10.9%</td>
</tr>
<tr>
<td>ESRD on HD</td>
<td>11.4%</td>
</tr>
<tr>
<td>MI</td>
<td>23.9%</td>
</tr>
<tr>
<td>s/p Cardiac Surgery</td>
<td>31.1%</td>
</tr>
<tr>
<td>Overall</td>
<td>15.9%</td>
</tr>
</tbody>
</table>

Larkin, Gregory. Resuscitation. 2010 (14)

Selection bias leads to survival rates that are overinflated relevant to the patient population with whom we usually discuss code status.

2. Adverse events
   A. Prolonged death in the hospital
      Myerburg. American Journal of Medicine 1980. (17). This was an observational study that looked at what would predict survival to hospital discharge. It noted that people who failed to survive to discharge often died from causes other than arrhythmia.
   B. Trauma from CPR
      Hoke. Resuscitation. 2004. (18). Krischer. Chest. 1987 (19). These studies looked at the trauma from the mechanics of CPR. The Hoke article is a literature review. The Krischer article was an autopsy study. The numbers will vary. The numbers in my handout will get you in the ballpark.
   C. Worse neurological status.
      This is by far the hardest one to come up with good numbers. Good neurological status varies depending on how many people transition to hospice/palliative care in the hospital and therefore make survivors seem to do better. (selection bias). For outpatients, a study from Japan by Kitamura Circulation 2012 (6) is the most systematic study looking at out of hospital CPR. Trials in the US are regional and subject to differences in EMS systems. For inpatients, Goldeberger Lancet. 2012 (15). for all adults and Abbo JAGS 2013 (1) for older adults are the key studies.
**Teaching points**

1. The decision regarding CPR is separate from any decision regarding life sustaining care

2. Listen to goals of care first
   - a. Goals (Longevity, comfort, function, quality of life and the balance of these)
   - b. Limits (Pain tolerance, side effect tolerance, risk tolerance of bad outcomes, failure or adverse events)

3. How to “get the DNR”

   **Agent model of decision making**
   What I heard you say is that....
   - Your goals are comfort oriented
   - Your goals are functionally oriented
   - You have goals for dying peacefully that are important to you
   - You are not a gambler
   - When unexpected outcomes have happened you have regretted the decision
   - You are not interested in something that works only very rarely
   - You are not willing to risk dying hooked up to machines
   - You said being dependent would make life not worth living
   - You are more likely to end up with a QOL worse than what you find tolerable than you are to end up how you are now
   - You have turned down other interventions that are painful, risky etc…. (hints)
   - Your goal is to fix your underlying illnesses
   - You barely tolerate how you are now and you are much more likely to end up worse off than you are now. AKA CPR can make you worse
   - You would like to live longer but it isn’t worth it (ie acknowledge how some fits but some parts don’t)

Therefore I think that CPR does not seem to fit your goals

   **Informed consent model of decision making**
   If you willing to acknowledge that
   - CPR usually does not work
   - Is more likely to cause a prolonged/painful death
   - Is more likely to leave you significantly impaired
   - Is more likely to make your health status worse
   - Than surviving to be the same
   - Coming back to how you are now is only about 8-10% (or low)

And you are willing to live with all of the potential outcomes
   - Trauma and pain from CPR
   - Dying on a ventilator in the ICU
   - Being in a vegetative state
   - Living in a nursing home
   - Being unable to be independent in Communication, toileting and other self care
   - Giving up the idea of dying peacefully and having CPR be the last thing you experience
   - Making a decision about PEG tubes now

then CPR seems to be a good choice
Tools to “get a DNR”

<table>
<thead>
<tr>
<th>Before</th>
<th>After - Patient centered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Describe CPR in harsher and harsher terms</td>
<td>Goal oriented</td>
</tr>
<tr>
<td>Try to make someone give up living longer</td>
<td>Not therapeutic/palliative</td>
</tr>
<tr>
<td>Hide efficacy</td>
<td>Dying goals not met</td>
</tr>
<tr>
<td>Risk oriented (acknowledges desire to live longer)</td>
<td>Likely risks to QOL (placement/dependency)</td>
</tr>
<tr>
<td></td>
<td>Likely risks of trauma</td>
</tr>
<tr>
<td></td>
<td>Likely risks of low efficacy</td>
</tr>
<tr>
<td></td>
<td>Certain risks to dying peacefully</td>
</tr>
<tr>
<td>Pain/trauma limits</td>
<td>Rib fx/potential trauma</td>
</tr>
<tr>
<td></td>
<td>Mechanism of CPR</td>
</tr>
<tr>
<td></td>
<td>Prolonged death</td>
</tr>
<tr>
<td>Efficacy oriented</td>
<td>Absolute rates</td>
</tr>
<tr>
<td></td>
<td>Relative rates</td>
</tr>
<tr>
<td></td>
<td>Qualitative outcomes</td>
</tr>
<tr>
<td>Informed consent vs Agent model</td>
<td></td>
</tr>
</tbody>
</table>
Bibliography


