PRIMARY SURVEY
Airway: open airway, head tilt, chin lift
Breathing: assess, bag mask ventilation
Circulation: check pulse, begin CPR
Defibrillate: pulseless VT or VF 200, 300, 360 Joules

SECONDARY SURVEY
Airway: secure with endotracheal intubation
Breathing: check breath sounds
Circulation: place IV, check EKG, starts appropriate medication
DDX: treat reversible causes

VF/PULSELESS VT
Shock, shock, shock: non-synchronized 200, 300 360 joules; survival is determined primarily by length of time from onset of VF to electrical defibrillation.

Valenzuela et al. reported in NEJM 10/2002, a prospective observational case series of 148 patients with out of hospital cardiac arrests in casinos (105 had VF, 17 PEA and 26 asystole), where they trained security officers to use defibrillation on arrival. Primary outcome was survival to discharge from hospital. Subgroup analysis was performed on 90 patients with witnessed VF. Results revealed a significant improvement in survival of those defibrillated within 3 minutes of collapse (74%) vs. those defibrillated more than three from collapse (49%).

Valenzuela et al. reported in Circulation 1997, a logistic regression analysis of two retrospective study groups (total of 1872 patients) with out of hospital witnessed cardiac arrests due to VF, with main outcome of survival to hospital discharge. Results identified only two significant predictors for improved survival, which were time from collapse to CPR and defibrillation.

Vasopressin 40 units IV (potent vasoconstrictor, elevated in patients with shock and post cardiac resuscitation, animal studies revealed increased coronary blood flow and cerebral blood flow), clinical studies reveal conflicting results; possible increase survival of initial resuscitation.

Steil et al. reported in The Lancet 7/2001, a DBRCT of 200 patients with in-hospital arrests (95 PEA, 61 asystole, 42 VF) when according to ACLS protocol when epinephrine was indicated, patients were randomized to 40 units vasopressin or 1 mg epinephrine. Primary endpoint was a measurable pulse post one hour of arrest and secondary outcome was a combination of survival to hospital discharge and MMSE. Results revealed no difference in either outcome.

Linder et al. Reported in Lancet 1997, small DBRCT of 40 patients with out of hospital cardiac arrest due to VF refractory to shock, randomized to either 1 mg epinephrine or 40 units vasopressin. Primary outcome was successful resuscitation (admission into ICU requiring no further resuscitation), secondary outcome was a combination of survival at 24 hours, survival to hospital discharge and neurologic outcome. Results revealed a significantly increased survival of initial resuscitation (35% vs. 10%); all other endpoints were not significantly different.

Presently, Voelker and Linder are conducting a large, multi-center trial to evaluate 40 units of vasopressin vs epinephrine in out of hospital cardiac arrest patients due to VF, PEA and asystole, primary endpoint is hospital admission.

Epinephrine 1mg IV q 3-5 minutes, *no clinical trial evidence of efficacy over placebo.*
- Steill et al. reported in NEJM 1992, a DBRCT of 600 patients with in and out of hospital arrests, randomized to either 7 mg epinephrine or 1 mg epinephrine. Primary endpoint was successful resuscitation. Results revealed no change in outcome.  

Amiodarone 300 mg IV bolus, antiarrhythmic. *two trials that confirm that amiodarone increases survival to ICU admission, better than placebo or lidocaine,* not powered to see effect on hospital discharge or death
- Dorian et al. reported in the NEJM 3/2002, a DBRCT of 347 patients with out of hospital cardiac arrests due to VF refractory to shock and 1 mg epinephrine, randomized to either lidocaine or amiodarone (5 mg/kg). Primary endpoint was survival to ICU admission, secondary endpoint survival to hospital discharge. Results revealed significantly increased survival to ICU admission in amiodarone group (22 % vs. 12%, ARR 10%, RRR 80%, NNT 10), secondary endpoint was not significantly different.
- Kudenchuck et al. reported in NEJM 9/99 a DBRCT of 504 patients with out of hospital VF/NSVT cardiac arrests that were refractory to shock and 1 mg epinephrine, randomized to either 300 mg amiodarone or placebo. Primary endpoint was survival to hospital admission. Results revealed a significant increase in survival to admission in amiodarone group (44% vs. 34%, ARR 10, RRR 30%, NNT 10).

Lidocaine 100mg IV, antiarrhythmic, *no clinical trial evidence of its efficacy.*
- Herlitz et al. reported in Resuscitation 1997, a retrospective study of 1360 patients with out of hospital VF arrests, which compared outcomes of those that received lidocaine and those that did not. Results revealed an increase in survival to hospital admission (38% Vs 18%) but no change in discharge.

Procainamide 20-30 mg/min IV drip, *no clinical trial evidence of its efficacy.*
- No clinical trial evidence, there is one retrospective analysis that preformed a multivariate analysis of post arrest patients and found procainamide was independently associated with hospital admission.

Magnesium 2 gram IV if hypomagnesemic state suspected, *otherwise no clinical trial evidence of its efficacy.*
- Thel et al. reported in Lancet 1997, a small DBRCT, of 150 patients with in hospital arrests (all types, except torsades) who received either 2 grams magnesium or placebo. NO statistical difference in primary endpoint of restoration of spontaneous circulation at one hour.

Remember: perform CPR post medication infusion for at least 30 seconds to allow medication to distribute, check rhythm, if still in VF/NSVT you must shock again, before starting new medication.

PEA ARREST
- Diagnose reversible causes: think out loud about your differential diagnosis 5H/5T’s, get labs
- Hypovolemia, hypothermia, hyperkalemia, hypoxia, +H (acidosis)
- Tamponade, tension pneumothorax, thrombosis (myocardial infarction, pulmonary embolism), tablets (overdoses).
- Initiate empiric treatment, according to patient’s history and exam
- Intubate and hyper ventilate, wide open fluids, bicarbonate bolus, calcium gluconate, D50 with insulin, pericardiocentesis or needle decompression
- Epinephrine 1 mg IV q 3-5 minutes
- Atropine 1mg IV q3-5 minutes if rate is slow
- Thrombolysis: tissue plasminogen activator, *one clinical trial reported NO improvement survival.*
- Abu-Laban et al. reported in NEJM 5/2002, a DBRCT of 233 patients with out of hospital cardiac arrest due to PEA refractory to fluid bolus, 1 mg epinephrine, intubation and ventilation.

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randomized to either 50 mg tPA or placebo. Primary outcome was survival to hospital discharge. Results revealed no significant differences in any outcome.

ASYSTOLE
Confirm true asystole in two leads, do not miss coarse VF, and search for reversible causes
Immediate transcutaneous pacing
Epinephrine 1 mg IV q 3-5 minutes
Atropine 1 mg IV q 3-5 minutes

POST ARREST CARE
Hypothermia two clinical trials reported improved neurologic outcome at discharge and 6 months.
- Holzer et al. reported in NEJM 2/2002, an outcome BRCT of 275 patients’ s/p VF/pulseless VT arrest that had been successfully hemodynamically resuscitated. Exclusion criteria included temp <30, comatose before arrest due to CNS depressant drugs, response to verbal commands, persistent hypotension (> 30 minutes) and persistent hypoxemia (>15 minutes). Patients were randomized to either hypothermia, goal bladder temp of 32-34 degrees, achieved with cooling blankets and ice packs if needed, for 24 hours vs. normothermia treatment. All patients were sedated and paralyzed. Primary outcome was favorable neurologic outcome in 6 months. Secondary outcomes were morality at 6 months and complication within 7 days. Results revealed a significant increase in favorable neurological outcome in patients with hypothermia (55% vs. 39%, RRR 40 %, ARR 16%, NNT 6), secondary endpoint of mortality was also improved (44 % vs. 55%) and no difference in complication rates.
- Bernard et al. reported in NEJM 2/2002 an outcome BRCT of 77 patients’ s/p VF cardiac arrests that had been successfully resuscitated. Exclusion criteria were patients with cardiogenic shock, or had other possible etiologies of coma other than arrest. Patients were either randomized to hypothermia, goal bladder temp of 33 degrees by active cooling with ice packs for 12 hours or normothermia. Primary outcome was survival to hospital discharge with sufficiently good neurologic function to go home or to rehab. Results revealed a significant increase in discharge form hospital with good neurologic function in-patients with hypothermia (49% vs. 26%, 23 % ARR, 88% RRR, NNT 4). No difference in complication rates.

COMMON ERRORS
- Leadership: failure to take control of session
- Procedural : unfamiliarity with defibrillator use

STOPPING THE CODE
- Always a difficult decision.
- Prolonged CPR beyond 30 minutes without return of spontaneous circulation is usually futile.
- Walraven et al. reported in the Archives of Internal Medicine 1/99, a clinical predictive model, derived from 1077 patients with in hospital codes (enrolled in RCT’s) and with logistic regression analysis found the following three factors predict NO chance of discharge from the hospital: no pulse 10 minutes after the start of CPR, initial cardiac rhythm was not VF/pulseless VT, unwitnessed arrest. They tested this model in their same cohort and found 100 sensitivity.

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10 Holzer et al. “Mild Therapeutic Hypothermia to Improve Neurologic Outcome after cardiac Arrest” NEJM. Vol. 346, 2002


