Sedation with Isoflurane after Cardiac Arrest using the AnaConDa Device Feasbility and Outcome

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Early neurologic evaluation is of utmost concern after Cardiac Arrest (CA) and CPR. Compared to standard regimens of analgesia and sedation volatile anesthetics have the advantages of controllability, short duration and lack of development of tolerance. In addition, volatile anesthetics seem to have preconditioning effects for ischemia and ischemia-reperfusion damage as well as neuroprotective effects and might therefore lead to better neurological outcomes.
We conducted a change of treatment for patients admitted to our 12 bed ICU after CA using isoflurane and low dose sufentanil for sedation and analgesia from time of ICU admission since 08-2011. We assessed duration of isofluran sedation and ventilation, neurohumological markers and RASS as well as GP-CPC on discharge from the ICU. Treatment with isofluran was only limited by availability of isofluran monitoring device with initially 1 monitor and later on 2 monitors being available. All pts were treated with mild hyothermia for 24h and then rewarmed over 16hrs with a CoolGard device. Hemodynamical monitoring (PiCCO, EV1000, PAC) were inserted when clinically needed. From 08-2011 to 05-2012 we treated 29 pts with isoflurane after CA (76% male, 66.4±11.7yrs). Hospital mortality was 28%. Mean treatment duration with isoflurane was 4,4±2.4 dys, mean ventilation time was 12.2±9.9 (survivors(S) 14.6.±9.7, non-survivors (NS) 5.9±7.6) days. Of the 21 S 17 patients showed a favorable neurological outcome (GP-CPC 1 or 2). Time to RASS ≥-3 in these S was 3.6±2.5 dys . On day 3 92% of S with good neurological outcome but none of the S with bad neurological outcome showed a drop in NSE levels. Mean NSE levels on day 1 to 5 were significantly lower for S with good neurological outcome compared to S with bad neurlogical outcome but not different from D. None of the pts showed adverse events or increased hemodynamic instability while treated.
Treatment with isofluran after CA was feasible and safe, fastened awakening but did not reduced ventilation time. In this small cohort mortality mortality was lower than the 40.2% mortality the in a comparable cohort of OHCA 97 pts included in a NSE/S100 study 2009-2010 before isoflurane treatment was introduced. 81% of S showed a preferable neurological outcome. Larger, possibly randomized trials on the effects of volatile anesthetics after CPR are needed.

Background

- Cardiac Arrest (CA) is the leading cause of death in Europe and the USA affecting around 38/100,000 population as Out-of-Hospital CA and up to 5 of 1000 hospital admissions as intrahospital CA
- Mortality and morbidity after CA are high with high numbers of severe neurological sequelae
- Improvement of CPR techniques and post-resuscitation care aim at improving outcome after CA
- Volatile anesthetics have been previously shown to have beneficial effects on ventilation times, cardiac function and hemodynamic stability, function of the autonomous nervous system and offer superior pharmacokinetics with faster return of consciousness and controllable depth of sedation via endexspiratory concentration of the inhaled anesthetic
- Effects of routine use of isoflurane after CA are not clear but might lead to improved mortality and neurological outcomes and facilitate quicker neurological evaluation

Methods

- University Hospital Aachen, 12 bed ICU (Cardiology, Pulmonolgy)
- Change of standard-of-care for patients after CA with an indication for mild hypothermia to be sedated with isoflurane using the AnaConDa device in combination with low-dose sufentanil
- Titrated sedation to endexspiratory concentration of Fet 0.2-0.6%
- Mild hypothermia at 33° C for 24h and controlled re-warming of 0.25° C / h using a ThermoGard intravenous cooling device
- Sedation at least until reaching a core temperature of 37° C
- Prospective data collection and NSE levels day 1 to 5
- Use of AnaConDa device was only limited by availabillity of Dräger Vamos gas-monitors (2)
- Hemodynamic monitoring when clinically indicated

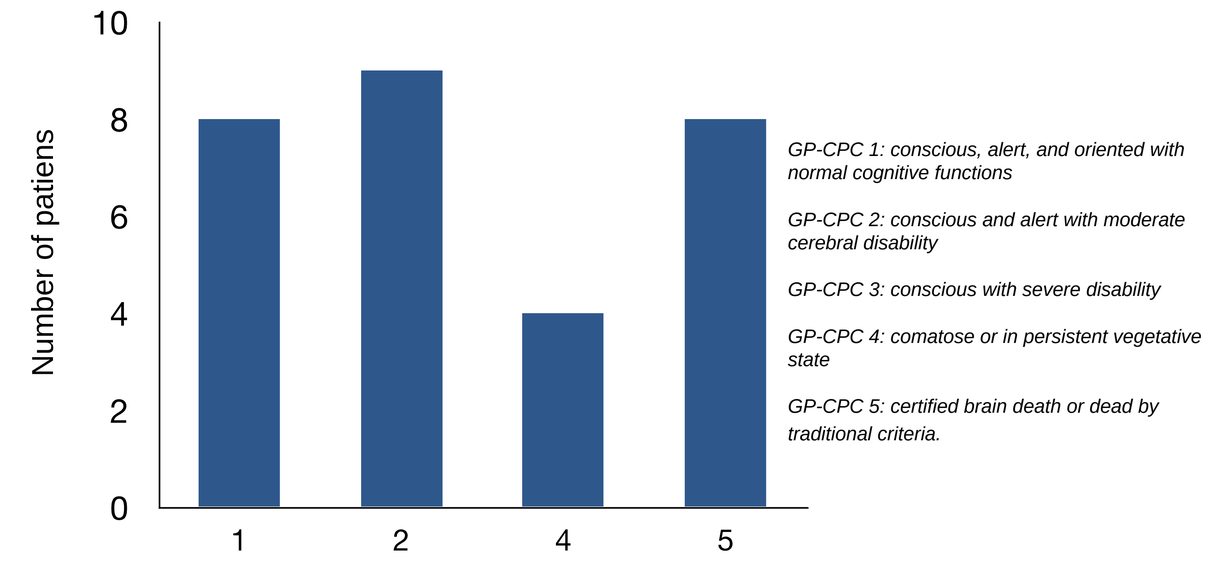
Results

- From 08/2011 to 05/2012 we treated 29 patients with isoflurane after CA
- 23 cardiogenic shocks, 4 septic shocks, 1 hemorrhagic shock, 1 anaphylactic shock
- Overall hospital mortality was 28%
- 81% (17 of 21) of surviving patients showed a favourable neurological outcome with a Glasgow-Pittsburgh Cerebral-Performance-Category (GP-CPC) of 1 or 2
- A comparable cohort from our center in 2009 to 2010 showed a 40% mortality and a favorable neurological outcome in survivors of 67% [1]

Table 1 – basic chararcteristics and treatment data

	all	survivors	dead	p
Gender (%male)	75.9	71.4	87.5	0,63
Age (years±SD)	66.4±11.7	64.8±12.2	70.8±9.6	0.23
ICU length of stay (days±SD)	16.4±13.1	20.0±13.0	7.1±8.2	0.02
Time on ventilator (days±SD)	12.2±9.9	14,6±9.7	5.9±7.6	0.03
Isoflurane treatment (days±SD)	4.4±2.2	5.2±2.3	2.5±1.4	0.01
CPR duration (minutes±SD)	23.9±22.8	21.8±14.0	29.4±38.4	0.43
Time of hypoxia (minutes±SD)	4.4±2.8	4.3±2.3	4.8±3.9	0.70

Figure 1: Glasgow-Pittsburgh Cerebral Performance Categories



81% survivors showed a good neurological outcome (GP-CPC 1 or 2)
Mean time to a RASS of ≥-3 in these survivors was 3.6 ± 2.5 days

Figure 2: Mean NSE levels stratified by GP-CPC

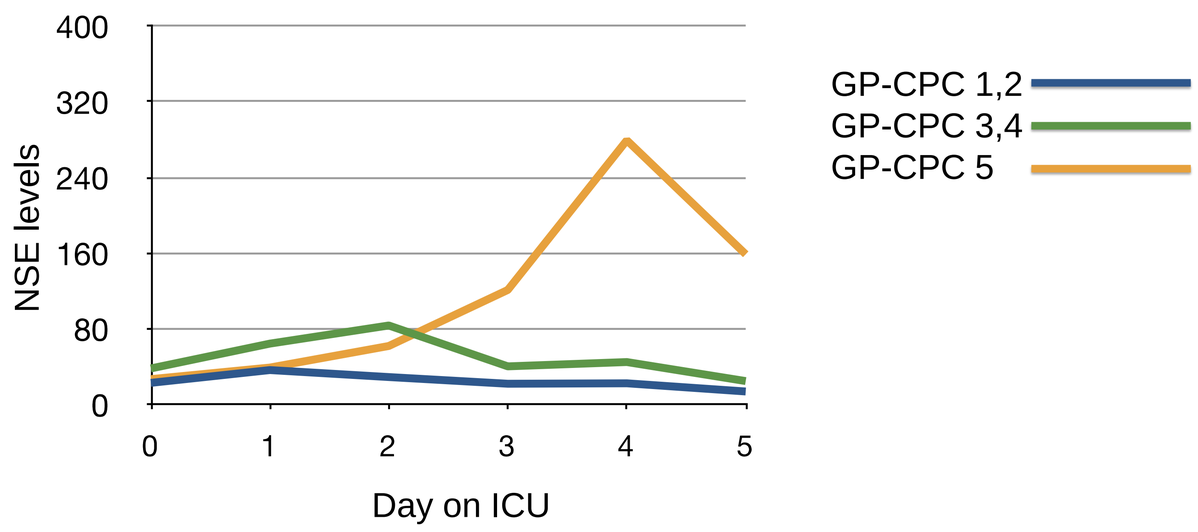


Figure 3: NSE trends stratified by GP-CPC

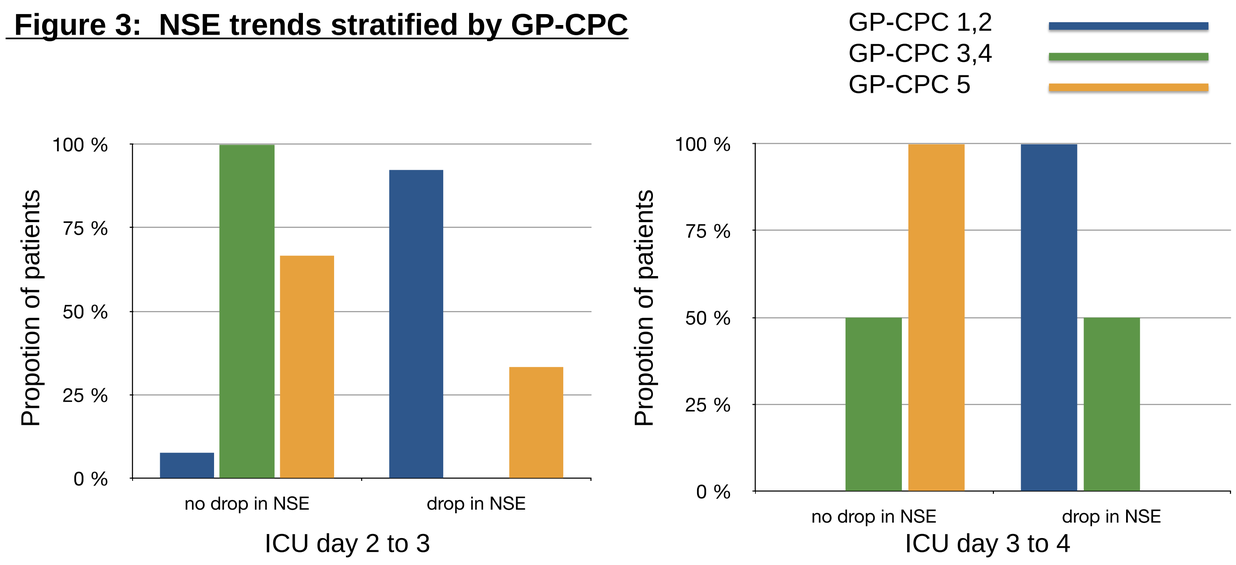


Figure 4: Ventilation time stratified by GP-CPC

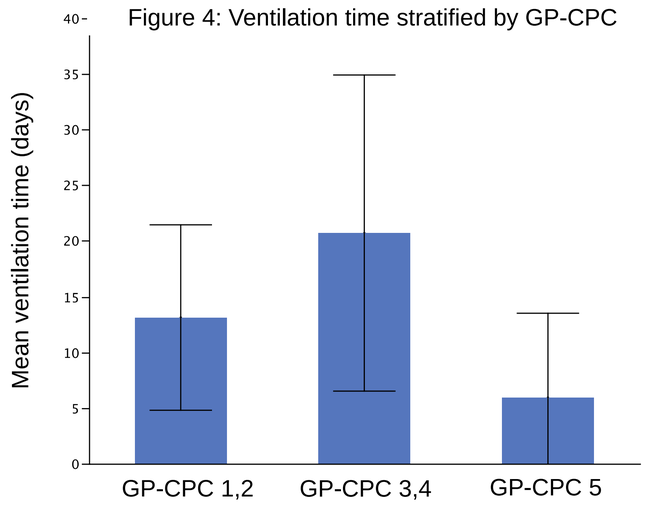
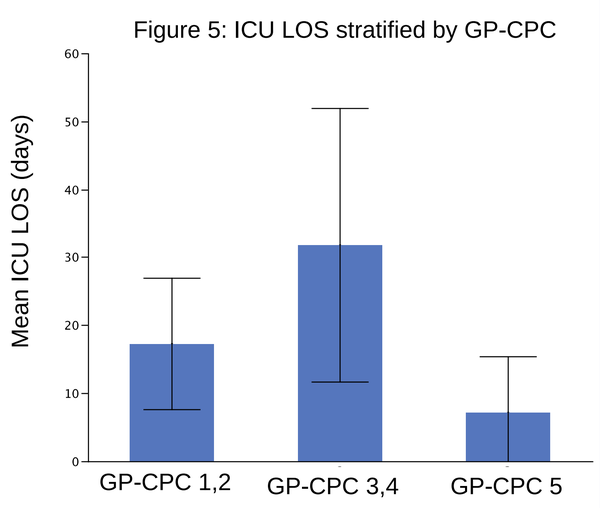


Figure 5: ICU LOS stratified by GP-CPC



Conclusions

- Compared to a similar cohort isoflurane treatment improved outcome measures but time on ventilators and ICU LOS were still high
- Time to awakening and possible neurological evaluation was short, however patients who survived with bad neurological outcomes still stayed long in the ICU
- Larger trials on isoflurane effects after CPR are needed

1 . Rana, O. R., Schröder, J. W., Kühnen, J. S., Saygili, E., Gemein, C., Zink, M. D. H., Schauerte, P., et al. (2012). The Modified Glasgow Outcome Score for the prediction of outcome in patients after cardiac arrest: a prospective clinical proof of concept study. *Clinical research in cardiology : official journal of the German Cardiac Society*. doi:10.1007/s00392-012-0423-7