Fever control using a "CoolGard System"

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BACKGROUND

Patients admitted to Critical Care often have problems with thermoregulation, inparticular patients who have sustained burn injuries. Various therapies to control normothermia are tried, one of which is continuous venous – venous haemofiltration (CVVH).

This treatment is highly invasive, involves approximately two hundred millilitres of blood being circulated via the external circuit which can lead to cardiovascular instability and homeostatic disturbances.

WHAT IS THE ALTERNATIVE?

A contemporary treatment using the

"CoolGard 3000"

A cooling system which uses a similar principal to CVVH but with less disruption to homeostasis.

WHAT IS IT & HOW DOES IT WORK?

- A triple lumen central line with three small balloons mounted on the end of the distal lumen which is attached to an electronic cooling device. The central line can be inserted into the subclavian, jugular or femoral veins
- Saline is circulated through the balloons at a controlled rate and set temperature. A target temperature is entered into the electronic cooling device. The distal end senses changes in the patient's core temperature and automatically adjusts the temperature of the circulating saline within the catheter.
- The surface area of the balloons filled with cool saline cools the blood which in turn reduces core temperature.

PATIENT AUDIT

A small retrospective audit consisting of seven patients was conducted over a 3 month period within the authors' Critical Care unit in 2005. The patients involved in the audit all received CVVH for thermoregulation because conventional therapies had failed. Data from three of the patients used in the audit have been included in this poster.

DATA ANALYSIS

Patient A
Admitted with Pneumonia, Length of Stay 20 days, Cost Of CVVH consumables / Treatment **£4,223.12**, Comparative Cost Using Cool Line System **£851.00**
Saving **£3,372.12**

Patient B
Admitted with 28% Burn,Length of stay 20 days, Cost Of CVVH Consumables / Treatment **£4,646.48**, Comparative Cost Using Cool Line System **£1,201.00**
Saving **£3,445.48**

Patient C
Admitted with Toxic Epidermal Necrolysis, Length of stay 16 days, Cost of CVVH Consumables / Treatment **£1,905.23**, Comparative Cost Using Cool Line System **£851.00**
Saving **£1,099.23**

Pro's v's con's of CVVH

PRO's

- May remove septic mediators depending on molecular size
- Effective cooling method

CON'S

- Sedation maybe required which can have a negative inotropic effect leading to cardiovascular instability
- Use of inotropes may be required
- May cause electrolyte disturbances
- Can affect homeostasis with acid-base disturbances
- Can cause coagulopathies as anti-coagulants are usually required to prevent the external circuit from clotting
- May cause renal failure and severe dehydration if fluid balance figures are inaccurately calculated
- May increase patients length of stay due to complications associated with CVVH

Pro's v's con'S of CoolGard

PRO'S

- Catheter surface coated with heparin. Additional anti-coagulation therapy to prevent clotting not required
- Sedation may not be required
- Does not involve blood being removed from the intravascular space, less risk of cardiovascular instability
- Renal Function is not compromised

CON'S

- Central line has only three lumens, majority of critically ill patients on multiple infusions require a central line with at least five lumens
- Could mask signs of infection if normothermia induced and white cell count not checked
- Could reduce temperature too quickly and cause cardiac arrhythmias such as bradycardia

CONCLUSION

Controlling hyperthermia remains a controversial topic. Some studies suggest cooling critically ill patients improves outcome, (Tisherman 2002) While others dispute it, (Cairns et al, 2002). Equally controversial is the debate regarding conventional therapies verses new therapies.

The small amount of research available used large RCT's. Sample sizes varied between 77 and 296. Research of this calibre is considered to be reliable, based on `The Five Strengths of Evidence' criteria as described by McSherry et al (2002).

The effectiveness of the Cooling system is supported by a majority of the literature and appears to cause less side effects than CVVH when used for thermoregulation alone. However the author feels that more research using RCT's is required.

To conclude, cooling should be done based on the individual patients' assessment using the most effective therapy available and the consequences as discussed in this poster considered.

Although the research suggests a raised body temperature is Common to all critically ill patients, the authors have found from personal experience, hyperthermia is more apparent in patients who have sustained burn injuries.

Treating the symptomatic patient makes theoretical sense in the context of preventing further complications and could have implications for management of fever in other critically ill, haemodynamically compromised patients.

Future Recommendations

In order to dispute the controversy that treating pyrexia is of benefit, further multi-centred research using large RCT's with heterogeneous samples are required.

In addition, further independent research is also required to test the efficacy and reliability of the CoolGard system and reduce bias.

The CoolGard system is a promising approach to thermoregulation and as we search for new ways of controlling it we should also consider which patients are most appropriate for aggressive treatment and under what circumstances.

FURTHER READING

Brosessner, G. Beer, R. Franz, G. Lackner, P. Engelhardt, K. Brenneis, C. Pfausler, B. Schmutzhard,E. (2005). **Case Report: severe heat stroke with multiple organ dysfunction – a novel approach.** Critical Care. 9:R498-R501. Available at http://ccforum.com/content/9/5/R498. (Accessed on 02/02/2006). Cairns, Chris, J.S., Andrews, Peter. (2002) **Management of Hyperthermia in Traumatic Brian Injury.** Current Opinion in Critical Care. Volume8(2)p106-110. Tisherman, S. A. (2002)**To Control Temperature all you need is a "cool" line.** (Editorials). Critical Care Medicine. Volume 30(11), pp2598-2600. Available at http://gateway.uk.ovid.com/gw1/ovidweb.cgi (Accessed on 02/02/2006).