

Haemodynamic optimization in the peri-operative period covers a multitude of related procedures; the adequate and timely management of heart failure as a chronic condition, the control of limiting angina or cardiac dysrhythmias, and the restoration of adequate circulating blood volume in a unstable acutely ill patient. These are all established peri-operative treatment targets and are widely accepted and practiced. However haemodynamic optimization also refers to the practice of goal-directed haemodynamic treatment (GDHT) in the peri-operative. GDHT has been around for a long time, but implementation is patchy at best; is the evidence poor, does the evidence compare badly to other well accepted treatment regimes, or do other factors influence this patchy uptake?

The understanding of the factors that influence the decision making of Physicians is unclear, there is no specific evidence on influencing decision making in Anaesthesia or Critical Care, and there is little evidence on how Physicians accept new ideas, and how these can be influenced, particularly if a fundamental change in practice is required. A number of sources are used such as published material, the influence of meetings such as this one, discussions with peers, and the importance of consensus and learned reviews from clinical leaders. Importantly in areas that might affect peri-operative patients significant changes in practice have been driven as part of a ventilation care bundle and a sepsis care bundle. It is helpful to compare the research, results and evidence, and implementation of the GDHT to these established care bundles.

Regardless of the treatment techniques that might be suggested to improve surgical outcomes there certainly seems to be an important problem. Taking data specifically from the UK 1.3 million in-patient general surgical procedures are performed each year, with approximately 25,000 deaths. Of these, 166,000 can be identified as high-risk surgical procedures. This is only 12.5% of the surgical procedures but accounts for 80% of the total mortality, so that around 12% of these patients die following major surgery and as many as 70% develop complications [1]. The post-operative complications within 30 days of major surgery are a more important determinant of long-term survival than either pre-operative co-morbidity or intra-operative adverse events. [2]. In the UK, widespread changes in the organisation of peri-operative care, have failed to reduce the number of peri-operative deaths.

The principle of the GDHT has been around since the 1960's following outcome observations in the USA. Shoemaker noted that mortality rates, despite increasingly complex interventions and techniques, were not improving in high risk surgical patients and attempted to analyze in a pragmatic fashion differences in physiological response between the survivors and nonsurvivors in an attempt to see if a possible physiological target for treatment had been missed. He found that the biggest differences between survivors and nonsurvivors were in the area of flow and tissue perfusion related physiological parameters [3] There is no difference in this approach to identifying target parameters than that normally used to identify heart rate, blood pressure, or blood transfusion thresholds. Shoemaker and colleagues then hypothesised that in addition to the routine physiological targets additional treatment goals should be set corresponding to these higher blood flow and perfusion parameters [4]. This is what has become known as GDHT and has subsequently been tested in a number of interventional clinical trials. The way that the GDHT has evolved is to move away from a specific technological approach to one of the philosophy of care in which a main treatment toward specific flow and perfusion parameters is as important as that towards, for example, an accepted blood pressure. It doesn't matter how you measure the blood pressure for you consider this an important part of peri-operative care, just as it does not necessarily matter which flow and perfusion parameters are used, or exactly how you measure them. A number of trials have assessed the value of GDHT in surgical patients.

The trials have examined the effects of GDHT when commenced at slightly different times in the peri-operative period, starting before during or after surgery, and have used a number of different methodologies. The many methodology differences between these trials included choices of monitoring technology, patient group, timing and duration of protocol, treatment end-points and the therapies used to achieve them. But as emphasized above the philosophy of treatment remains consistent, that of increasing blood flow and perfusion. It is likely that in the future new techniques such as peripherally measured PAs contour analysis, and pulse pressure variation may also be suitable parameters, used as a surrogate measure of perfusion, to test in a GDHT study.

The results of studies identified beneficial effects of GDHT ranging from reductions in duration of hospital stay, peri-operative costs, complication rates, and mortality. However, there are a number of exceptions, particularly in the case of vascular surgery. There have also been a number of systematic meta-analyses of these data which have shown difficult reduction in hospital stay, complications and mortality [5-7]. So why doesn't everyone do it?

It is likely that a combination of factors are important:

- Anaesthetists and intensivists, who are likely to be at the forefront of GDHT, have no familiarity with preventative medicine.
- The terminology of is confusing.
- There is a problem with identifying patients who might benefit.
- This is not sexy media medicine.
- The evidence is not convincing enough.
- It is all too simple and is done routinely anyway.
- It is too difficult to implement these complex changes in practice.
- There is no peer pressure to undertake a GDHT protocol.
- GDHT has not reached a critical mass of acceptance.
- GDHT has been confused with the debate on efficacy of pulmonary artery catheterization.
- GDHT has been used in situations other than peri-operative medicine with very different results.
  - Very ill patients have had a major procedure carried out, the surgery, and nothing more is likely to be beneficial for them.
  - It is unclear how to go about establishing a GDHT protocol.
  - $\beta$ -blockade rather than increasing flow is the way forward in peri-operative care.

Most of the points above do not relate to evidence base, and a comparison between the power of the evidence base for GDHT and other routine practice ICM and anaesthetic interventions is greatly in favour of using GDHT. Other treatment and therapeutic options are in a similar situation to GDHT having a powerful evidence base but little implementation, it seems to be psychological processes within the care givers themselves that leads to this dissociation.

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