

Commentary

Advances in protocolising management of high risk surgical patients

E David Bennett

St George's Hospital, Blackshaw Road, London SW17 0QT, UK

Corresponding author: E David Bennett, ebennett4@mac.com

Published: 20 February 2006

This article is online at <http://ccforum.com/content/10/1/124>

© 2006 BioMed Central Ltd

Critical Care 2006, **10**:124 (doi:10.1186/cc4848)

Abstract

Despite studies clearly demonstrating significant benefit from increasing oxygen delivery in the peri-operative period in high risk surgical patients, the technique has not been widely accepted. This is due to a variety of reasons, including non-availability of beds, particularly in the pre-operative period, and the requirement of inserting a pulmonary artery catheter. There are now data that suggest that increasing oxygen delivery post-operatively using a nurse-led protocol based on pulse contour analysis leads to a major improvement in outcome with reduction in infection rate and length of hospital stay.

In 1988 Shoemaker and colleagues [1] published a pivotal and rather complex paper that demonstrated for the first time that increasing cardiac output and oxygen delivery peri-operatively in high risk surgical patients led to a dramatic fall in morbidity and mortality. His group had previously shown that using simple clinical criteria, patients at high risk of dying in the post-operative period could be easily identified. He estimated that as many as 8% to 10% of patients undergoing major surgery in the USA were in this high risk group, with a hospital mortality well in excess of 20%

Since these papers were published, numerous studies have by and large confirmed these original findings. Boyd and colleagues [2] and Woods and colleagues [3] found that increasing cardiac output and oxygen delivery pre-operatively to target values of 4.5 l/min/m² and 600 ml/min/m², respectively, which were maintained into the post-operative period, all led to a dramatic reduction in both mortality and morbidity. These studies all used the pulmonary artery catheter for monitoring cardiac output and a combination of intra-venous fluids and inotropes to achieve the hemodynamic targets.

Other workers [4-6] have used oesophageal Doppler to measure cardiac output intra-operatively and achieved maximal stroke volume using frequent fluid challenges but with inotropes. Such protocols have consistently led to significant reductions in post-operative complications and hence hospital length of stay. Two further studies [8,9] demonstrated that

when such protocols were used solely in the immediate post-operative period, similar benefits were still obtained.

It should be stressed that these protocols have been used in a wide variety of patients, ranging from those undergoing major abdominal and vascular surgery to repair of fractured neck or femur or major cardiac surgery. Disappointingly, despite this body of evidence and meta-analyses that clearly show the overall benefit of this approach, the technique has not been widely adopted for reasons that are not entirely clear. These probably include disbelief, ignorance and logistical difficulties, particularly in regard to intensive care facilities. In addition, the major debate about the efficacy of the pulmonary artery catheter has further compounded the difficulties.

The relative lack of intensive care beds in the UK has in general made it impossible to admit high risk surgical patients to the intensive care unit pre-operatively. It has been estimated that in the UK approximately 40,000 surgical patients are admitted annually for post-operative intensive care, with an overall hospital mortality of around 20%. This is associated with a prolonged length of stay and a very high complication rate.

It was against this background that the recently published study by Pearse and colleagues [10] was undertaken. Would it be feasible to develop a protocol in which identical goals to those achieved by Shoemaker almost 20 years ago for cardiac index and oxygen delivery would be sought purely in the immediate post-operative period? And could these hemodynamic goals be reached and maintained using the relatively new technology of pulse contour analysis calibrated by lithium dilution? And, furthermore, if such a protocol did lead to a significant improvement in outcome, could it then be implemented on a routine clinical basis in all patients receiving post-operative care in the intensive care unit at St George's Hospital in London? The study did of course show a dramatic reduction of 12 days in the mean length of stay,

mainly due to a fall in the post-operative infection rate. Furthermore, about two thirds of the study was carried out by senior nursing staff, giving encouragement to the notion that a routine clinical protocol that could be run by the general intensive care nurses might indeed be developed.

This has now happened and followed a period of detailed discussion and education. The protocol now in use is largely based on that used in the study and is run by the nurse assigned to the care of the patient. Immediately on return from the operating theatre, the patient is connected to the Lidco monitor via the radial arterial line and the lithium calibration procedure completed via the central venous line.

Oxygen delivery is continuously monitored and increased towards the target value of 600 ml/min/m², initially with intravenous colloid and then with the addition of dopexamine at a dose no higher than 1 µg/kg/min. The target value is not reached in a minority of patients, usually because the heart rate increases above 100 beats per minute.

It is hoped that about 500 patients annually will be treated with this protocol and, based on the results obtained in the study, up to 20 lives will be saved. To the delight of the hospital managers it is estimated that because of the projected reduction in hospital stay there should be an annual cost saving of at least £2,000,000.

It is encouraging to note that at the time of writing the Pearse and colleagues' study [10] is third in the annual list of most articles published in *Critical Care* [11] despite being on this list for only three months. This does suggest that the intensive care community is showing real interest, which hopefully will be translated into routine clinical practice.

Competing interests

The author declares that they have no competing interests.

References

1. Shoemaker WC, Appel PL, Kram HB, Waxman K, Lee TS: **Prospective trial of supranormal values of survivors as therapeutic goals in high-risk surgical patients.** *Chest* 1988, **94**: 1176-1186.
2. Boyd O, Grounds RM, Bennett ED: **A randomized clinical trial of the effect of deliberate perioperative increase of oxygen delivery on mortality in high-risk surgical patients.** *J Am Med Assoc* 1993, **270**:2699-2707.
3. Wilson J, Woods I, Fawcett J, Whall R, Dibb W, Morris C, McManus E: **Reducing the risk of major elective surgery: randomized controlled trial of preoperative optimisation of oxygen delivery.** *Br Med J* 1999, **318**:1099-1103.
4. Mythen MG, Webb AR: **Perioperative plasma volume expansion reduces the incidence of gut mucosal hypoperfusion during cardiac surgery.** *Arch Surg* 1995, **130**:423-429.
5. Sinclair S, James S, Singer M: **Intraoperative intravascular volume optimisation and length of hospital stay after repair of proximal femoral fracture: randomised controlled trial.** *Br Med J* 1997, **315**:909-912.
6. Venn R, Steele A, Richardson P, Poloniecki J, Grounds M, Newman P: **Randomized controlled trial to investigate influence of the fluid challenge on duration of hospital stay and perioperative morbidity in patients with hip fractures.** *Br J Anaesth* 2002, **88**:65-71.
7. Wakeling HG, McFall MR, Jenkins CS, Woods WG, Miles WF, Barclay GR, Fleming SC: **Intraoperative oesophageal Doppler guided fluid management shortens postoperative hospital stay after major bowel surgery.** *Br J Anaesth* 2005, **95**:634-642.
8. McKendry M, McGloin H, Saberi D, Caudwell L, Brady AR, Singer M: **Randomised controlled trial assessing the impact of a nurse delivered, flow monitored protocol for optimisation of circulatory status after cardiac surgery.** *Br Med J* 2004, **329**: 258.
9. Polonen P, Ruokonen E, Hippelainen M, Poyhonen M, Takala J: **A prospective, randomized study of goal-oriented hemodynamic therapy in cardiac surgical patients.** *Anesth Analg* 2000, **90**:1052-1059.
10. Pearse R, Dawson D, Fawcett J, Rhodes A, Grounds M, Bennett D: **Early goal-directed therapy after major surgery reduces complications and duration of hospital stay. A randomised, controlled trial.** *Critical Care* 2005, **9**:R687-R693.
11. **Critical Care top twenty most accessed articles of the past year** [<http://ccforum.com/mostviewedbyyear>].