Teaching in a Simulation Environment – Relevant to Day Surgery?

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This session will describe the use of physiological simulators to teach anaesthetic staff and how this is applicable to working in a Day Case Unit. Bristol Medical Simulation Centre, BMSC [1] has two METI [2] Human Patient Simulators (HPS) one adult and one six year old child, a METI Emergency Care Simulator (ECS), the Laerdal SimMan [3] and the ACCESS system [4] .

Day surgery and the anaesthetist

With the publication of the "Day Surgery: Operational Guide" [5] it has become clear that the government intends to promote day surgery over the next few years. Increasing the quantity of day case surgery helps to address the need for increased capacity in the NHS. However, increased quantity must not be at the expense of quality.

- Increasing the number of day surgical cases has many implications to an anaesthetic department:
- A need to train anaesthetists to provide high quality anaesthetic care tailored to the day case patient
- Access and expenditure on appropriate drugs and equipment to support high quality fast track care
- Development of criteria for patient selection beyond the present scope
- High quality and reliable pre-assessment
- Skilled assistance in theatre and recovery to aid swift through put of patients
- Clear guidelines and protocols to deal with cases with adverse incidents or need for prolonged care

2002 also saw the publication of NCEPOD "Functioning as a team?" [6]. Identifying the association between emergency admissions, surgical interventions and higher mortality rates after three days, this report highlights the need for good communication, teamwork and morbidity and mortality review across specialties. Although Day Surgery remains the province of elective rather than emergency cases, issues of good team working to achieve a high quality service are equally applicable to day surgery as they are to in-patient surgery. The need to report and review morbidity and mortality across specialties becomes increasingly important as day surgery opens its doors to patients previously considered unfit for surgery in the day case environment.

Physiological simulators

Anaesthetists are experts in human physiology and pharmacology. Simplistically the four different types of simulators at BMSC combine a physical human interface, a manikin with computer generated physiological signals and values of cardiovascular and respiratory physiology. These simulators have different degrees of manikin sophistication and physiological modeling.

Most simply the non-model driven system ACCESS combines a Laerdal airway trainer with a personal computer (PC). The ACCESS software displays basic monitoring (ECG, oximetry, blood pressure and simple gas analysis) on the PC screen (Fig1). The monitor displays can be altered by the trainer so that they represent different evolving medical or anaesthetic problems that fit a given clinical scenario. For example, the heart rate and blood pressure may go down in response to vagal stimulation, but the saturation remains the same.

At the other end of the spectrum, the model driven HPS provides a realistic full body manikin with mechanical hardware producing central and peripheral pulses, chest movement with inspiration and expiration of gases, eye opening and blinking and a number of other physical features (Fig 2). The software in these high fidelity manikin run models for cardiovascular, respiratory and neuromuscular systems that can be measured and displayed on real clinical monitors. So for example, in response to a dose of adrenaline, given via a drug recognition system, the heart rate and blood pressure would be seen to change on the ECG and non-invasive blood pressure monitors, without intervention from the trainer.

FIGURE 1

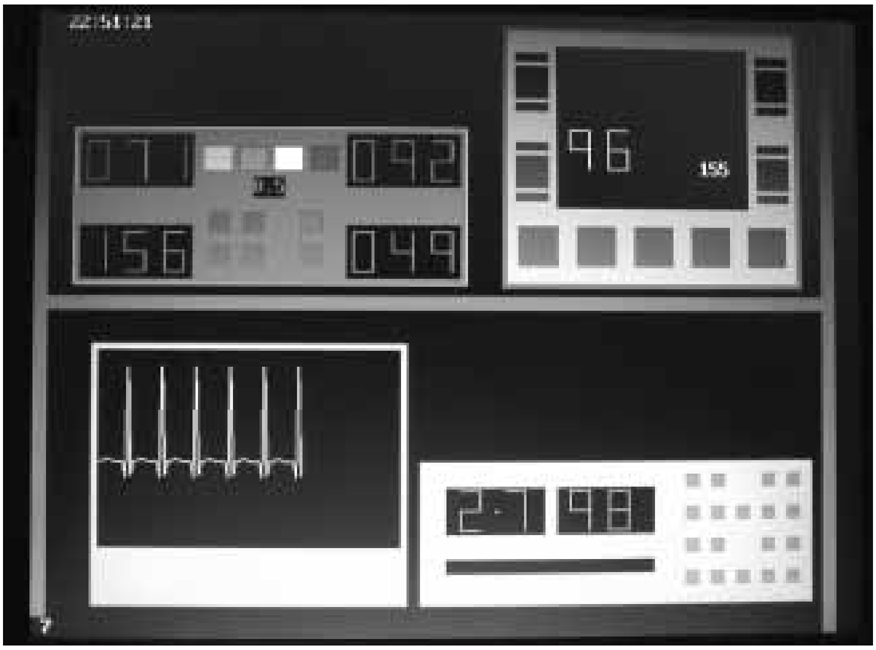

Figure 1: PC display screen showing ECG, oxygen saturation, blood pressure, end tidal CO2 and inspired oxygen concentration

FIGURE 2

Figure 2: The Human Patient Simulator

TEACHING WITH SIMULATORS

These different degrees of simulator fidelity and modeling allow plenty of scope for teaching anaesthetists, their assistants and other healthcare workers. Teaching can be subdivided into proactive and reactive topics.

Proactive topics: Using the simulator to teach understanding of principles and good practice

- Basic cardiovascular physiology
- Basic respiratory physiology
- Effects of drugs on cardiovascular and respiratory physiology
- Safe anaesthetic techniques e.g. rapid sequence induction, failed intubation drill
- New anaesthetic techniques e.g. use of Remifentanil infusions
- Introduction to new equipment e.g. infusion pumps, anaesthetic machines or ventilators

Reactive topics: Using the simulator to teach anaesthetists how to deal with difficult clinical situations

- Critical incident training e.g. oxygen failure, total spinal
- Anaesthesia Crisis Resource Management, a form of "team training" to empower the anaesthetist with skills of good communication, team working etc [7]

The scope for training anaesthetists working in the Day Surgery setting is obviously vast. Indeed the types of training listed above could be equally applicable to ITU/HDU, Recovery or A&E staff. Physiological simulators are excellent teaching tools for healthcare workers needing to learn about changing physiological patterns reflecting acute or chronic disease, or, pharmacological or physical interventions.

Teaching at BMSC: relevance to Day Surgery

In this section of the talk I would like to give examples of the way we have used simulators for teaching anaesthetists involved in caring for day case patients. These include examples of proactive and reactive teaching styles.

New anaesthetic agents -teaching old dogs new tricks

BMSC opened in January 1997. We immediately started working with the pharmaceutical industry to generate income to fund the centre. In 1997 and 1998 we taught anaesthetists about the use of Remifentanil in anaesthetic practice.

Using the adult HPS, anaesthetists could practice giving Remifentanil to different simulated patients. The HPS was pre-configured to "talk" to the infusion pump so that the pharmacodynamic effects of the drug could be demonstrated on the cardiovascular and respiratory models. Combined with a specific PC programme to give a visual display of the plasma levels of Remifentanil, the students could examine the effects of bolus doses, different rates of infusion and on and offset times. Initially the quick onset and offset of Remifentanil made it a potentially interesting drug for day case anaesthesia..

Sevoflurane was launched in later part of the 90's. This inhalational agent had been used widely in Japan for 5 years prior to the launch into UK practice. The strengths of Sevoflurane were many; little cardiovascular upset, lack of respiratory irritation and low blood gas solubility (0.6) making it a quick onset offset vapour suitable for inhalational induction and maintenance. Immediately it found favour with paediatric anaesthetists in and out of the day case setting. However, expense, old habits and a preference for intravenous inductions were a barrier to its introduction as both an inhalational induction agent or maintenance agent in adult practice.

The HPS has a realistic lung model. Real gases and inhalational agents can be given to the simulated patient and appropriate uptake modeled so that drug effects are triggered on the cardiovascular and respiratory systems and the appropriate exhaled concentration expired. This unique feature of the HPS enables close inspection and realistic practice of inhalational anaesthetic techniques including low flow. Sevoflurane was seen as expensive compared to other inhalational agents. By using sensible low flow techniques (the insolubility of agents like Sevoflurane and Desflurane makes them ideal agents for low flow) the issue of cost can be negated. In combination with an inhalational and uptake programme Gasman [8], a PC based simulator we can demonstrate quick and efficient methods of achieving low flow and then practice on the adult simulator for educational reinforcement. More recently we have developed a different programme for demonstration of Desflurane.

Teaching anaesthetists to handle difficult clinical situations

The pioneer of Crisis Management is David Gaba, an anaesthesiologist from Stanford University in California. He coined the term Anaesthesia Crisis Resource Management, ACRM, to refer to a simulation based course developed to address issues not normally found in anaesthetic texts i.e. improving the performance of the anaesthetist facing a demanding clinical emergency or crisis. In his book Crisis Management in Anesthesiology [7] he describes good principles of practice that anaesthetists should adopt when dealing with crisis. These principles include:

- Taking command as a leader
- Declaring an emergency early rather than late
- Employing good communication techniques
- Distributing the workload
- Calling for help
- Knowing how to utilize help available from every member of the team
- Repeatedly assessing and re-evaluating the situation

An ACRM uses small group teaching techniques in a simulation suite to teach and practice these principles.

At BMSC we have developed our own version of this type of teaching. Minor "critical incident" training enables anaesthetists to practice basic responding to simple anaesthetic problems, whereas our Team Training courses aim to explore and teach some of the ACRM principles including communication and team leadership.

Incidents occurring in the day case unit will be similar to those occurring in the major theatre suites. Unexpected haemorrhage, drug errors, patient collapse, equipment failures will occur and this type of training is wholly applicable to staff working in this environment. More specific courses have been designed for recovery support staff that focus on more common untoward recovery events.

With the drive to reduce waiting lists in the UK a number of mobile surgical units are being used by hospitals for day surgery procedures. A stand alone unit established for temporary use can lack land lines or proximity to a main hospital block. Training of personal to deal with problems occurring in these settings would be a good application of ACRM.

References

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