

Patient-maintained propofol sedation for orthopaedic surgery: Patient variability in system use

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Introduction

Over **800,000** operations are performed annually in the UK in the presence of an anaesthetist but without using general anaesthesia (Sury et al., 2014). A substantial number of patients experience anxiety when undergoing awake procedures (Mitchell, 2009). A variety of techniques have been shown to be effective at reducing procedural anxiety, including pharmacological sedation (Mackenzie, 1996).

Target controlled infusion (TCI) of propofol, under the direction of an anaesthetist, is a popular choice for intra-operative sedation because of the drug's favourable pharmacokinetic profile; this is how the drug is adsorbed, distributed, metabolised and excreted by the body (Schneider et al., 1998). However, anaesthetists have been shown to be inaccurate judges of pre-operative patient anxiety (Badner et al., 1990; Fekrat et al., 2006). This could result in either insufficient or excessive dosing of pharmacological sedation in relation to the actual requirements of individual patients.

One possibility for overcoming this is allowing patients control over their depth of sedation.

Patient-maintained propofol sedation has been previously tested in endoscopy (Stonell et al., 2006; Campbell et al., 2004), dental (Leitch et al., 2003; 2004) and outpatient surgical (Yun et al., 2008; Alhashemi & Kaki, 2006) settings. While this research has reported back favourably in terms of sedation concentration, patient recovery time and anxiety levels, to date there has not been a truly human-centred approach to the problem that fully considers the opinion and role of the patient within the system.

Methodology

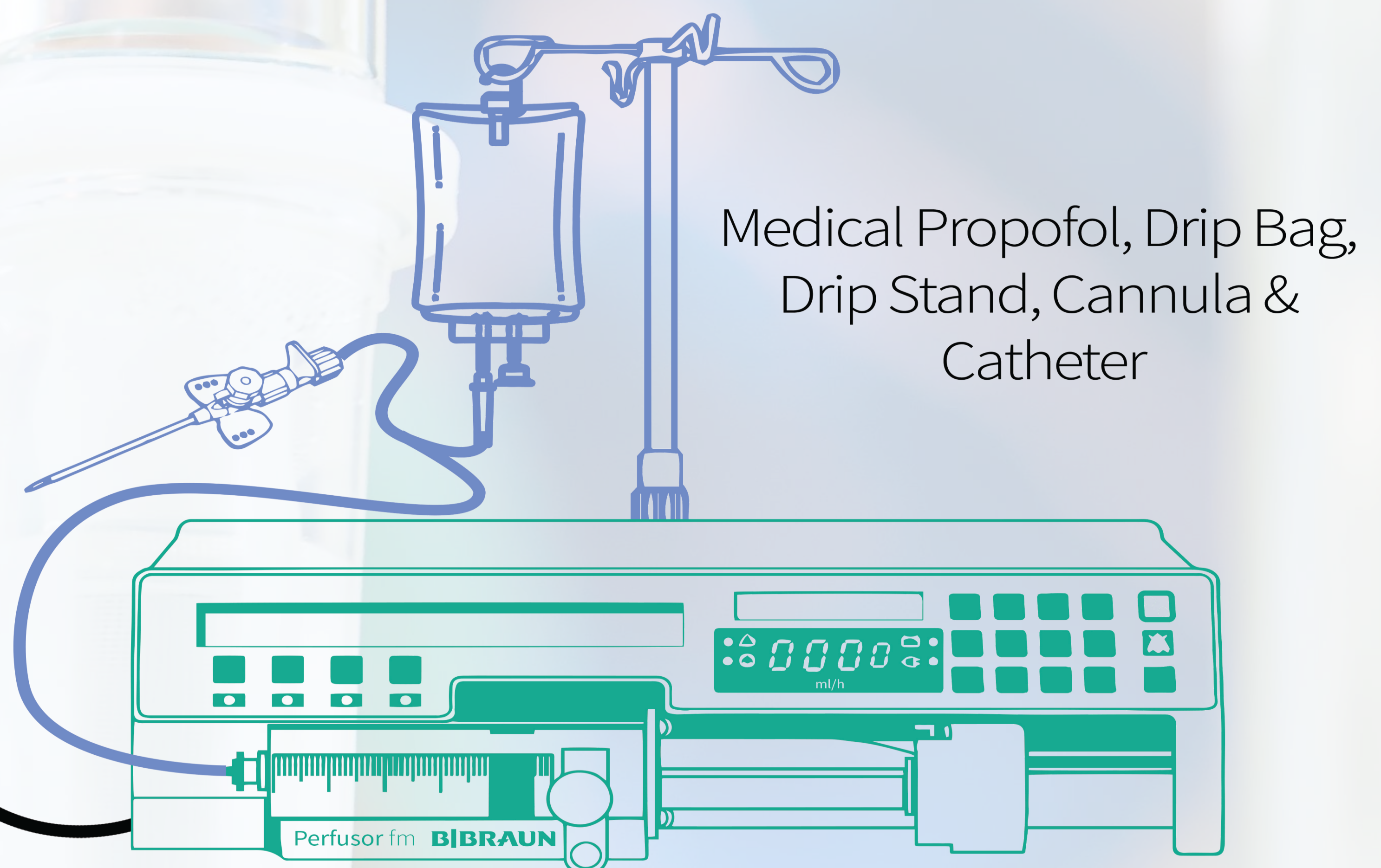
- 26 patients presenting for elective lower limb orthopaedic surgery under regional anaesthesia at Nottingham University Hospitals NHS Trust took part
- All expressed a pre-operative preference for surgery to be performed under sedation
- Patients were given a hand-held button triggering an audible beep when pressed, indicating a request for deepening of sedation
- Subjects were told: **"You will be started on a background level of sedation"** and **"If you feel anxious or want to be more sleepy, press your button to increase the sedation"**
- On hearing a beep indicating a button-press, the study investigator manually altered the effect-site target of the propofol infusion according to a standardised protocol
- Repeat button-presses were ignored until the calculated effect-site concentration was equal to the target (i.e. the lockout period was equal to the equilibration time)
- After recovery from sedation, a questionnaire was administered seeking feedback on the use of the button and satisfaction with sedation

Patient Button Interface



Anaesthetist User Interface

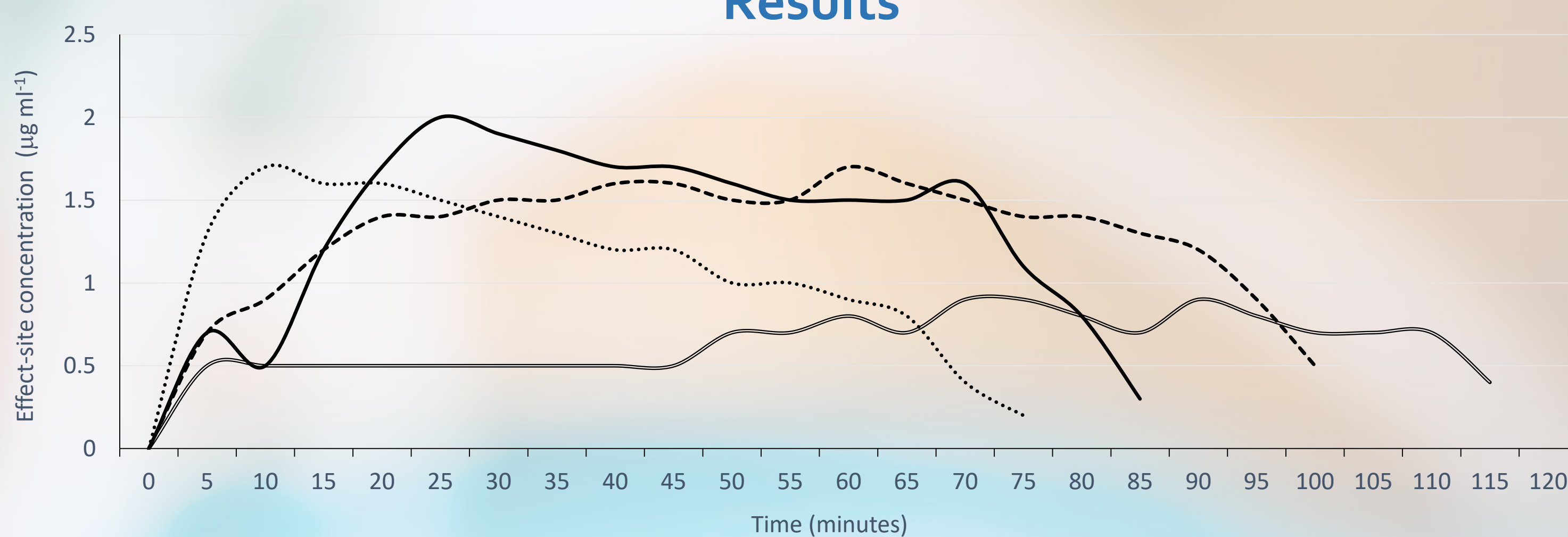
Two-way communication connection



Medical Propofol, Drip Bag, Drip Stand, Cannula & Catheter

B. Braun Perfusor fm[®] Infusion Pump

Results



4 types of patient behaviour:

- **Patient 1 (dotted line):** Appeared anxious pre-operation in the anaesthetic room, and therefore chose to obtain a relatively deep level of sedation as soon as given the button to press
- **Patient 2 (solid line):** Initially chose not to press the button when first available, but due to associated noise decided to deepen their sedation (between 10-15 minutes)
- **Patient 3 (dashed line):** Button usage was the most regular throughout the surgery – achieving a relatively steady state of sedation throughout
- **Patient 4 (double line):** Patient appeared relaxed for the majority of the surgery, and did not press the button until a major part of the surgery commenced (~45 minutes)

Conclusions

- Overall patients **liked** having control over their own sedation, were **happy** with their sedation level, and would use the same sedation technique again
- System provided a degree of **empowerment**; patients found it **reassuring** to be able to control their level of sedation (even though ~50% chose not to use the button)
- Lack of negative responses - this is perhaps surprising considering the lock-out period of button, and the associated unsuccessful button presses
- Although feedback from the patients suggests a strong **positive** consensus, this did not translate to uniform behaviour when using the system
- **Pre-op anxiety**, the **stage of the operation**, **environmental effects** (noise, vibrations etc.), and **sensitivity** to propofol can all influence the number and timing of sedation requests
- Patients' **pre-operative anxiety** could inform the **baseline** concentration of the sedation
- If patient-maintained propofol sedation is to be successfully adopted as an alternative to anaesthetist-led practices, the system needs to be robust to the **different ways** patients' use it

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