

[02RC1

Sedation in day surgery and office-based; drugs, techniques, monitoring and patient selection

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Sedation is used in many patients undergoing surgery, treatment or diagnostic procedures as a day case. Who provides this sedation varies around the world from the surgeon or physician involved in providing the procedure to what might be regarded as the ideal situation where it is provided by an anaesthetist. In the UK the main experience of operator-provided sedation is currently in gastroscopy and colonoscopy procedures. This is acknowledged to be linked to high levels of morbidity and mortality with one prospective audit suggesting that the incidence of mortality was 1 in 2000 and morbidity 1 in 200 cases [1]. Several papers including one British Medical Journal editorial [2] have stressed the importance of monitoring and the use of supplemental oxygen during these procedures. In this lecture I will review the literature and give an overview of the current knowledge about this subject.

Definition of sedation

A useful definition of sedation is 'A technique in which the use of a drug or drugs produces a state of depression of the central nervous system enabling treatment to be carried out, but during which verbal contact with the patient is maintained' [3]. When anaesthetists are involved in the provision of sedation we use various titles such as 'deep sedation' and many would argue that at the point when you lose verbal contact with the patient (and where airway support may be needed) we have entered the field of general anaesthesia – even though the range of procedures possible in these light planes will be limited. [4] These levels of sedation are not a suitable technique for the lone operator.

Patient selection

Sedation techniques should not be considered the easy option and it is vital that patients undergo some form of assessment prior to arriving for surgery. This can take the form of a screening questionnaire which is then reviewed and followed-up when indicated. An example of this is shown in Figure 1. The content of this screening tool needs to reflect the types of surgery and procedures being undertaken. For many surgical procedures it is important to understand if the patient is on certain key drugs, including anti-platelet and anticoagulant drugs such as aspirin, clopidogrel and warfarin. It is not safe to allow these drugs to be automatically discontinued pre-operatively as patients may then be at high risk of complications. The difficult patients are those on clopidogrel who have had a drug eluting stent inserted in the previous few months and patients on warfarin who have metal heart valves. While these are obvious high risk groups there are others who the physician is not aware of.

Figure 1

Example of a screening questionnaire

Day Surgery assessment for Local Anaesthesia Patients

Will you

be able to be driven home by private car? YES NO
 have someone to take you home? YES NO

Do you have any history of allergy to Local Anaesthetic drugs? YES NO

Do you suffer from any of the following

a heart attack within the last 6 months? YES NO
 angina (chest pain) that is poorly controlled eg attacks most days? YES NO
 diabetes managed with insulin? YES NO
 diabetes managed with tablets YES NO

It is important that you answer the above questions honestly. If you have had to answer NO to one of them please don't worry as we can usually help.

Information about your current drugs (medication)

Are you currently taking Methotrexate? YES NO
 Are you currently taking Warfarin? YES NO
 Are you currently taking Clopidogrel? YES NO
 Are you currently taking Aspirin or Ticlopidine? YES NO
 Are you currently taking dipyridamide (Persantin) YES NO

A nurse from the Day Surgery Unit may contact you over the next few days to get more details and offer advice. If you are taking any of the above drugs then we may ask you to stop your drugs for a few days prior to coming to hospital for your operation.

If we consider patients with atrial fibrillation who are on warfarin for the prevention of stroke, it is important to understand that there are subgroups who have an elevated risk of stroke (Table 1). The relative risk can be calculated using validated scoring systems such as the CHAD2 Score [5]. From this we can make a calculation about relative risk; for example, if we accept that patients undergoing a surgical procedure have their warfarin stopped 3-4 days pre-operatively and that their anticoagulation remains sub-therapeutic for a further 2-3 days, then there is a period of 7 days when their management is sub-optimal. Using this and the relative risk of stroke we can calculate that in the highest risk group, one patient will have a stroke for every 350 treated; I suggest this is not a small number and warrants careful consideration, even with a procedure under sedation.

Table 1

Atrial fibrillation patients at high risk of stroke

Proven atrial thrombus
Ejection fraction < 40%
A history of TIAs or previous stroke
Diabetes
Mitral stenosis
Hypertension
Mechanical heart valve

Patients who are on warfarin following deep venous thrombosis (DVT) or pulmonary embolism (PE) may also present a problem. Classically they have been managed with warfarin for 6 months, though after the recent trials this period of time may be extended [6]. It has been calculated that the risk of stopping warfarin in first month after DVT is associated with a 1% per day chance of recurrence; during the second and third months this risk drops to 0.2% per day and after the third month the risk decreases to 0.04% per day [7]. Using similar calculations as above, if warfarin is stopped in the first month then one patient will have a further DVT for every 17 people treated compared with one patient for every 400 treated if we wait until 4 months. This hopefully demonstrates that many of the issues we consider for our patients undergoing general anaesthesia equally apply to the population undergoing sedation techniques.

Monitoring and facilities

Monitoring requirements should take into account the patient's health, the drugs being used and the depth of sedation planned. It is satisfactory to monitor a young fit patient with pulse oximetry and by maintaining verbal contact. The elderly and those with cardiovascular disease will require monitoring of ECG and blood pressure. Any unit providing sedation techniques should have the following readily available [4]:

- Suitably trained individual to monitor the patient
- ECG
- Non-invasive blood pressure monitoring
- Pulse oximetry

Further requirements include:

- The patient should be sedated on a trolley or operating table that can be tipped head-down
- Oxygen should be readily available
- Full resuscitation equipment should be available
- The staff looking after the patient should be trained and regularly updated in resuscitation techniques.

Drugs currently available

The main drugs used for sedation are midazolam, propofol and remifentanyl.

Midazolam

Midazolam has largely replaced diazepam as it is water soluble and causes far fewer problems on intravenous injection. It has a half-life of ~ 2 h (compared with > 20 h for diazepam). The dosage for sedation is ~ 0.07 mg.kg, though this should be reduced in the elderly. The incidence of patients slow to metabolise this drug is up to 50% in some populations, but in clinical use this has little effect on recovery times. These characteristics have led to the use of midazolam by intermittent injection for sedation and in the UK it is the drug of choice in endoscopy units

Propofol

Propofol has a context sensitive half-life that only reaches 9 min after a 3 h infusion. It has, therefore, enjoyed great popularity for intravenous infusion for anaesthesia and increasingly for sedation. There are an increasing number of infusion pumps available that allow the clinician to target either the blood level or the effect-site concentration. It can also be used as part of a patient controlled sedation system discussed below.

Remifentanyl

Remifentanyl undergoes rapid hydrolysis by tissue and plasma esterases to a compound that has little activity. This rapid metabolism means it has a context sensitive half-life that remains at 3 min even after a 3 h infusion. It is increasingly used for sedation of patients undergoing surgical procedures.

Techniques

Manual control of sedation with propofol

For manual control of sedation using infusion pumps, evidence suggests a loading dose of 0.2-0.5 mg.kg followed by an infusion in the range of 0.5-4 mg.kg.hr is required [8].

Target controlled infusions for sedation with propofol

When using target controlled infusions (TCI) blood levels of 0.4 to 1.0 $\mu\text{g}\cdot\text{ml}$ have been shown to be effective for sedation linked to regional anaesthesia [9]. However, other studies using this technique for endoscopy have found that young patients require levels as high as 4 $\mu\text{g}\cdot\text{ml}$ [10]. This is in keeping with the author's experience of the use of TCI propofol in endoscopic retrograde pancreato-cholangiography (ERCP) patients. There is a large variation in the blood levels required to complete the procedure with some patients requiring levels previously described as 'deep sedation' when a degree of airway support is required. It would seem intuitive that the sedation requirement will vary between patients and with the degree of stimulation from the procedure being performed.

Patient controlled sedation with propofol

Early studies showed that a regimen allowing 25 mg boluses to be requested every minute allowed patients to rapidly achieve sedation [11]. Once again, many studies have examined sedation for endoscopy procedures and for patients undergoing regional anaesthesia [12, 13]. The regional anaesthesia studies have usually used dosage regimens of 0.3 mg.kg, with various lock-out times ranging from 0 to 3 min. It is worth noting that pain on injection was a problem for several patients using this technique. Perhaps more worryingly several of the endoscopy papers have looked at using a combined bolus of propofol (4.8 mg) and alfentanil (12 μg) with no lock-out period. This may not present a challenge when an anaesthetist is present to monitor the patient. However, I suggest these techniques are being considered for use without an anaesthetist present in many countries. Experience from dental sedation in the UK suggests the safety profile of such sedo-analgesia mixtures should be examined closely before they are considered for widespread adoption.

Manual control of sedation with remifentanil

Infusion rates of 0.025-0.1 $\mu\text{g}\cdot\text{kg}\cdot\text{min}$ titrated to patient response have been found to be effective [14]. The use of remifentanil at these doses provided similar intra-operative conditions and comfort for the patients as propofol but with reduced sedation scores [15, 16]. However, this was linked to greater respiratory depression and a greater incidence of nausea and vomiting in the recovery period. Its use in more painful procedures may be associated with an increase in requirements to 0.25 $\mu\text{g}\cdot\text{kg}\cdot\text{min}$. Remifentanil use can increase the success rate of local anaesthetic procedures.

Conclusion

During this lecture I have attempted to provide an overview of the current drugs, techniques and dosages being used for sedation. There is no doubt that these techniques can be used in office-based practice by anaesthetists when appropriate monitoring and support is available. Guidelines for this have been produced in the UK and are presented for consideration. I have also provided some guidance about patient selection and urge colleagues to ensure that patients undergoing procedures under sedation receive appropriate assessment pre-operatively.

Key Learning Points

- Sedation techniques have a high level of morbidity and mortality.
- Patients undergoing sedation techniques should undergo screening or pre-operative assessment prior to surgery.
- Warfarin or anti-platelet drugs should not be routinely discontinued without careful assessment of why the patient is on these drugs.
- Sedation techniques should only be used where there is appropriate equipment and where staff have regular resuscitation skills updates.

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