Chapter 6: Sedation

Peter Renton is a 30-year-old builder who was admitted to ICU 10 days ago with crush injuries from an industrial accident. He has multiple lung contusions, difficult to ventilate and his clinical observations and biochemical results suggest that he is developing acute renal failure and sepsis. In order to facilitate ventilation and other interventions, Peter has been sedated with intravenous infusions of

- Midazolam 10 mg/h for 10 days
- Alfentanil 5 mg/h for 10 days
- Propofol 250 mg/h for 7 days

In addition Peter received intravenous vecuronium at 10 mg/h for 8 days, which was changed to bolus administration of pancuronium on day 8.

Q1. Calculate the total amount of sedation given to Peter in relation to the recommended dosage, drug metabolism & elimination (pharmokinetics). Evaluate possible long term complications and outline some nursing strategies which can minimise these.

Q2. Review the appropriateness of sedation hold with Peter. Plan how this is best managed e.g. time of day, reduction in infusion rates, order in which to stop infusions, which infusions should continue, assessment of sedation level, goals of sedation

Q3. Consider the actions (pharmodynamics) of vecuronium and pancuronium and provide the rationale for changing paralysing agents on Peter’s 8th day.

A1. Midazolam total dose = 2400 mg over 10 days or 240mg / day. The recommended dose (BNF 2005) for sedation of patients receiving intensive care is 30 to 200 mcg/kg/h. Assuming Peter weighs an average of 75 kg, the dose he has been receiving is 133 mcg/kg/h, so within recommended dosage, but likely accumulation. Hepatic and renal dysfunction will reduce its metabolism and elimination and therefore prolong its action. The effect of this can increase Peter’s time to wake, dependence on mechanical ventilation (from increased respiratory depression), paradoxical confusion and agitation.

   Alfentanil total dose = 1200 mg over 10 days or 120 mg / day. The recommended dose (BNF 2005) for sedation of patients receiving intensive care is 30 to 50 mcg/kg/h. Assuming Peter weighs an average of 75 kg, the dose he has been receiving is 67 mcg/kg/h, so in excess of recommended dosage. A prolonged infusion > 4 days increases duration of effect eg respiratory depression; supplemental analgesia is required after stopping infusion. See Chapter 7 Pain Management (p71) for further discussion of opioids.

   Propofol = 42 000 mg over 7 days or 6 000 mg / day. The recommended dose (BNF 2005) for sedation of patients receiving intensive care is 0.4 to 4 mg/kg/h. Assuming Peter weighs an average of 75 kg, the dose he has been receiving is 3.3 mg/kg/h, so within recommended dosage, but likely accumulation. Peter’s developing renal dysfunction will reduce its clearance and prolong its action and adverse effects eg decreases BP, negative inotropic effect. Propofol will also load Peter with unwanted ‘fat’ emulsion in his blood.

   Nursing strategies to minimise some of these complications include a daily sedation hold and titrate sedation to a sedation score.

A2. Daily sedation hold is appropriate, as Peter has been sedated for 10 days. Plan to stop sedation in the morning e.g. stop longer acting sedatives (Midazolam half-life = 2-4 hours) and analgesia at 6am, stop shorter acting sedatives (propofol, alfentanil) after nurse handover at 8am. Consider continuation of alfentanil or use supplemental analgesia to prevent breakthrough pain. Avoid bolus of muscle relaxants with sedation holds. Assess sedation using a numerical scale (See Chapter 6 Sedation p62 for examples of scales), aim for Peter target score to be rousable to voice, comfortable and pain free on minimal levels of sedatives.

A3. Both vecuronium and pancuronium are steroid-based muscle relaxants, metabolised by the liver and excreted by kidneys. Vecuronium is associated with far less adverse cardiovascular effects than pancuronium. Vecuronium should be used with caution as Peter is developing acute renal failure; this can
prolong its effects. Pancuronium has positive vasogenic properties (increases HR, can cause tachycardia), is longer acting so can be effective as bolus. Peter has crush injuries and these agents can compound muscle problems. Discuss with clinicians and consider using Atrcurium over Vecuronium as infusion, as it self-degrades with less liver involvement.