Anaesthesia for the athlete: volatile or TIVA?

Robertson S
The Canberra Hospital, Australia
Correspondence to: Dr Simon Robertson, e-mail: srobertson@grapevice.com.au

The amateur or professional athlete presents for surgery for many reasons, often related to his or her particular sport. Rarely, this may occur in the emergency setting, immediately after cessation of exercise. While there are several issues to be dealt with in anaesthetising this group of patients, the choice of anaesthetic technique will be focused upon here.

Considerations in the athlete for elective surgery

While regional anaesthesia is not included in the scope of this abstract, this needs to be seriously considered in the athlete. In this regard, not all regional anaesthetics are equal in terms of long-term sequelae. Neuraxial anaesthesia is regarded as relatively safe, but even minor, transient neuropraxies from nerve blocks can have a devastating effect on an athlete’s career.

Effects of hypnotic agents on muscle

Both propofol and volatiles have effects on muscle. Propofol’s immediate effect on muscle is to cause elevations in muscle blood flow relative to sevoflurane. On a cellular level, propofol uncouples the electron transport chain (particularly between complexes I and II) and reduces electron flow down the entire chain. This is associated with reduced oxygen utilisation and reduced energy production. If associated with other mitochondrial abnormalities, catecholamines, corticosteroids and severe illness (such as systemic inflammatory response syndrome [SIRS]), this may cause the propofol infusion syndrome (PRIS). While PRIS may occur rapidly - even after a total intravenous anaesthesia (TIVA) general anaesthetic - and has a high mortality rate, there is only one case report of an athlete experiencing this syndrome. This athlete had other significant risk factors for the development of PRIS.

Recovery from general anaesthesia

Both propofol and the insoluble volatiles have favourable emergence and recovery profiles. While there may be statistical significance in their “street readiness” times, clinical significance is minimal.

Steroid abuse

Increasingly, anabolic steroid abuse is not restricted to elite athletes, but is encountered in recreational athletes, bodybuilders, police forces and the military. There are many serious effects of anabolic steroid abuse, including:

- Hypercoagulability. There are numerous reports of myocardial infarction and cerebrovascular accident.
- Long-term atherosclerosis.
- Hepatotoxicity and induction of hepatic enzymes.
- Psychiatric effects such as wild mood swings.
- The possibility of abuse of other drugs: diuretics, thyroxine, growth hormones and others.

Where steroid abuse is a particular concern, TIVA may be preferred in order to avoid some of the emergence effects of the short-acting volatiles.

QT prolongation

One well-described feature of the athlete’s heart is apparent conduction abnormality, including PR and QT prolongation, ventricular ectopy and inter-ventricular conduction abnormalities. These ECG features frequently disappear...
when the athlete exercises. However, athletes may be predisposed to malignant arrhythmia, with a reported incidence of ventricular fibrillation on the sports field of approximately 1:150 000. There may be great clinical difficulty in distinguishing an athlete’s heart activity from cardiac pathology.

Sevoflurane causes much greater QT prolongation than propofol. This may have clinical significance in the athlete with resting QT prolongation, especially if he/she also experiences ventricular ectopy. In this setting, TIVA with propofol is preferable.

**Considerations in the recently-exercised athlete**

The exercising athlete is an autonomically deranged (supra-normal) organism. The alveolar minute volume is massively elevated, consequent to enormous CO₂ generation. The systemic vascular resistance is lower than the sickest septic shock patient in the nearby ICU. The splanchnic blood flow is reduced. Thermoregulation is geared to dissipate as much heat as possible, rendering the athlete relatively poikilothermic and passive to environmental temperatures.

It would be extremely unusual to encounter an emergency so dire that the majority of these effects would not already have been reduced. However, there are a few pitfalls to anaesthetising the recently exercised.

**Post-exercise hypotension**

There are numerous mechanisms for the observed fall in blood pressure after exercise. In laboratory conditions, this effect lasts for up to four hours and is mediated by persistent muscle vasodilation. This vasodilation is both arterial (causing a reduced systemic vascular resistance) and venous (causing a reduced cardiac output due to venous pooling and reduced venous return). The implications for anaesthesia are that the athlete may experience significant hypotension. Here, volatiles may be preferred to TIVA, as they cause less peripheral vasodilation.

**Succinylcholine**

Excessive fasciculation has been reported in all muscle in bodybuilders and in recently-exercised muscle in other athletes. Several case reports also highlight a more tonic muscle contraction than fasciculation. The metabolic and electrolyte consequence of this is unclear. If succinylcholine is to be used in an emergency, the patient should be adequately protected from injury.

**Thermoregulation**

The recently-exercised athlete has deranged thermoregulation. Temperature monitoring is essential. Neither TIVA, nor volatiles has specific advantages here.

**Conclusion**

There are little hard data to inform the decision to choose TIVA or volatiles for the athlete presenting for surgery. More important is to assess the patient clinically as one would in every circumstance, and conduct a good anaesthetic, choosing familiar hypnotic agents and analgesics.