

## **Adverse Events – Peripheral Nerve Blocks as a Tool to Reduce Unwanted Outcomes after Anesthetic and Surgical Care**

Over the last decades, great strides have been accomplished in terms of preventing significant morbidity and mortality associated with the delivery of general anesthesia and it is not an overstatement to say that general anesthesia is safer than ever before.

However, adverse events such as dental damage, intraoperative hypothermia, intraoperative blood loss, and others do still occur quite frequently. While healthcare providers often consider such occurrences minor in nature, patients may have a very different perspective. Moreover, the additive effects in terms of costs of treatment associated with such “minor events” should not be underestimated and can add substantially to the operational burden of an institution. Utilizing peripheral nerve blocks as technique to provide surgical anesthesia can significantly reduce the incidence of “general anesthesia specific” risks and side effects. For instance, perioperative dental damage is the most common complaint resulting in the greatest number of malpractice claims against anesthesiologists. Costs for dental repair can easily reach several thousands dollars per case, not considering legal fees and awards for pain and suffering. Another frequent unwanted event is the development of sore throats after general anesthesia, caused by either the endotracheal tube as well as by laryngeal mask airways. Avoidance of laryngoscopy and intubation or laryngeal mask placement by performing peripheral nerve blocks as the sole anesthetic technique will obviously eliminate the risk of both of these complications and their associated treatment costs.

Another area in which the “right” anesthetic technique can make a big difference regarding the outcome is the development of thromboembolic events including deep venous thrombosis (DVT) and pulmonary embolism (PE). Patients undergoing surgery in general and especially orthopedic procedures are at high risk to develop such a complication. It has been reported that the cost associated with a thromboembolic event averages \$10,804 for a DVT and \$16,644 for a PE. Regional anesthesia techniques and specifically continuous peripheral nerve blocks are associated with a reduction of the incidence of these unwanted events probably via two different mechanisms: In one study researchers found a lower incidence of proximal DVT (proximal DVTs are considered more likely to result in PEs) when lumbar plexus blocks were utilized for total hip replacement. This result was contributed to vasodilation secondary to sympathectomy in the extremity undergoing surgery. It is now also well established that early ambulation after total joint replacement reduces the risk for thromboembolic events. Continuous catheter techniques have consistently been demonstrated to facilitate such early ambulation by providing superior pain control when compared to traditional methods.

Intra- and postoperative blood loss can also be reduced with peripheral nerve block techniques. During surgery, hemodynamic stability is superior when procedures are performed solely under regional blocks or in combination of general anesthesia with regional anesthesia. The fact that the patients cardiovascular response to the surgical stimulation is practically abolished due to the nerve block technique, translates into fewer episodes of spikes in blood pressure and consequently in less bleeding in the surgical field. Postoperatively, superior pain control on the hospital floors provided by continuous nerve block techniques also reduces hypertension and associated blood loss that

otherwise would occur in response to less efficient methods of pain management (e.g. breakthrough pain during mobilization or physical therapy).

During general anesthesia, normal central thermoregulatory responses are inhibited causing a reduction in sympathetic tone and redistribution of body heat from the core to the periphery. The resulting hypothermia can lead to a higher incidence of cardiovascular complications such as myocardial ischemia or arrhythmia. Furthermore hypothermic patients also are at increased risk for bleeding, development of wound infections, and delayed wound healing. These adverse events can add between \$2,500 and \$7,500 per surgical patient to hospitalization costs, with hypothermia only 1.5 degrees less than normal. Consequently, monitoring of body core temperature and prevention of hypothermia for instance with forced-air warming systems is recommended for any surgical procedure under general anesthesia lasting longer than 30 minutes. In contrast, peripheral nerve block techniques only inhibit thermoregulatory responses in the blocked area of the body. Since nerve blocks are usually limited to one extremity, the resulting effects on body core temperature are much less pronounced than those observed with general anesthesia. As a result, patients require less invasive monitoring and can in many scenarios undergo surgical procedures without the need for forced air warming blankets, which represents an approximate saving of \$20 per case.

In summary, regional anesthesia and especially peripheral nerve blocks can help to reduce several potential adverse events of anesthetic and surgical care. These benefits do not only benefit the patient, but at the same time, also allow for substantial cost savings by healthcare institutions and healthcare systems.