An epidural infection is a rare and extremely dangerous complication of epidural anesthesia. This case report describes an epidural infection following the use of a continuous lumbar epidural anesthetic. This patient was fortunate, in that the infection did not result in neurologic sequelae and required only long-term intravenous antibiotic therapy.

With the increasing use of epidural analgesia and anesthesia, it is important that anesthetists are aware of such a complication in this commonly used technique.

This article will review the incidence, pathophysiology, symptomology, diagnosis, and treatment of epidural infections. Factors relating to epidural infections (equipment use, fever, septicemia and viremia, and duration of catheterization) are also discussed.

Key words: Epidural abscess, epidural anesthesia, epidural infection.

Introduction
An infection developing in the epidural space has the potential for causing profound neurologic damage. Treatment usually involves surgery (laminectomy), followed by long-term antibiotic therapy. A case history of an epidural infection following epidural catheterization is presented. The pathophysiology, diagnosis, and treatment of epidural infections and abscesses are described. This discussion will focus on some of the more controversial topics involving the use of epidural anesthesia (e.g., in potentially septic patients) and evaluate ways of limiting epidural-related infections.

Case summary
A 77-year old male was admitted with a history of rectal bleeding. Colonoscopy and rectal exam revealed a large posterior rectal tumor. The history was positive for diabetes treated with glyburide, stable angina treated with nitroglycerin, digitalis for atrial arrhythmias, and cimetidine for peptic ulcer disease. Preoperative laboratory work was within normal limits.

An abdominal-perineal resection was performed without incident under combined general endotracheal and epidural anesthesia. The epidural catheter was placed between L3-4 after preparing with povidone-iodine and sterile draping. Povidone-iodine ointment was placed on the catheter insertion site, and the catheter was secured with tape. A micropore filter was used during anesthesia and for subsequent 8-hour boluses of epidural morphine. The epidural catheter was removed intact on the fourth postoperative day.

On the seventh postoperative day, the patient complained of tenderness around the epidural site (L3-4). The site was examined and found to be reddened and very tender. A small amount of purulent material was expressed and cultured. The initial diagnosis was a subcutaneous fistula or abscess versus an epidural infection. The patient was
started on 1 million units of intravenous (IV) penicillin every 4 hours. Although previously afebrile, the patient's temperature peaked at 101.8°F that afternoon. His complaints of lumbar back pain and tenderness also increased in intensity. On postoperative day 8, posterior-anterior and lateral spine radiographs were negative for abscess. The culture obtained from the epidural site was positive for penicillin-resistant staph aureus. The penicillin was discontinued, and 1 g of IV ampicillin was given every 6 hours, along with 500 μg of IV metronidazole every 8 hours and a 100-μg IV load of gentamycin, followed by a dosing schedule.

On postoperative day 9, the patient remained febrile and continued to complain of lumbar back pain and tenderness. Because of the continuing symptoms and the concern for a possible epidural abscess, a magnetic resonance imaging (MRI) and a neurosurgical consult were obtained. Since the patient was neurologically stable, an MRI was chosen over the more invasive myelography. The MRI showed altered signal density at L-2. The impression was parameningitis versus an epidural abscess. The patient had no neurologic deficits, i.e., cauda equina compression from an epidural mass. He continued to have febrile episodes, but by postoperative day 10, these had decreased from peaks of 102.5°F to 99.5°F. Because the patient was neurologically stable, the decision was made to continue IV antibiotics, monitor neurologic status, and obtain another MRI. As a result of the patient's need for prolonged IV antibiotics, a Groshong catheter was placed in the right internal jugular vein on postoperative day 14. An infectious disease consult recommended discontinuing the triple antibiotics and using 2 g IV nafcillin every 4 hours. A repeat lumbar MRI on postoperative day 15 showed a continued area of altered signal intensity at L-1. The patient continued to spike temperatures (99.3°F-102.3°F). On postoperative day 18, radiology performed a lumbar puncture at L1-2 and aspirated a few milliliters of serosanguineous fluid from the right posterolateral epidural space. The resulting cultures were negative. The patient was transferred to a county hospital, where he received a total of 4 weeks of antibiotic therapy.

Clinical presentation

This case study is unusual because the epidural infection was treated exclusively with antibiotics. In limited infections with no neurologic deficits, antibiotics have been used successfully. A more common finding with epidural infections is the development of an epidural abscess with progressive neurologic involvement. An epidural abscess is one of the most serious complications of spinal and epidural anesthesia.

- Incidence. The incidence of spinal epidural abscess is approximately 1 per 10,000 hospital admissions.1-3 Anesthesia-related infections are very rare. More commonly, such abscesses arise from surgical procedures, hematogenous spread of infection, trauma, and IV drug abuse.1,3

Although there have been a few reported cases of lumbar puncture (spinal anesthesia) related epidural infections, the most frequently implicated regional technique is epidural anesthesia.6

From obstetrics to pain management, the use of epidurals in anesthesia continues to grow, so there is an increasing potential for epidural-related complications such as abscesses.

- Pathophysiology. The epidural space exists between the dura of the spinal cord and the bony and ligamentous vertebral canal. This potential space extends from the foramen magnum to the sacrum and contains extradural fat and the internal vertebral venous plexus. It is evident that an abscess forming in this space has the potential to cause rapid and serious spinal cord damage.

Staph aureus is the most frequently cited causative organism in epidural infections.1,5,7,9 The bacteria usually gain entrance to the epidural space through contaminated drugs or equipment, or following a break in sterile technique. The average spread of the epidural abscess is 3-5 vertebral segments.1,3 The increasing mass of the abscess compresses the surrounding neurovascular tissue, causing the attendant back pain, weakness, and paraparesis. When the infected site is exposed at surgery (or autopsy), frank pus or granulated tissue (or a combination of both) is found.

- Symptomology. Back pain and fever, along with localized tenderness, are the most common presenting symptoms of an epidural abscess.1,3 However, there is a wide variation in initial signs and symptoms, and many patients have associated medical-surgical problems. This ambiguity often leads to a misdiagnosis, with resultant delays in initiating effective treatment.1,3

As the epidural mass grows, neurologic signs appear (muscle weakness, paresis, incontinence), making the diagnosis more apparent. In acute cases (signs and symptoms lasting less than 2 weeks), this becomes evident within 2-3 days of the initial complaint of back pain.3 Back pain, followed by spinal root pain and weakness (with bowel and bladder dysfunction) leading to paralysis, is the common clinical progression.5,9

Back pain and localized tenderness may be present for weeks in chronic cases (signs and symptoms lasting greater than 2 weeks). However, once
the transition to neurologic signs is made, deterioration can be just as rapid as in acute cases.\textsuperscript{11,13,11}

Fistula formation (cutaneous-epidural) following epidural catheterization, with symptomology mimicking chronic epidural abscess, has also been reported.\textsuperscript{12}

- **Diagnosis.** Early diagnosis is exceedingly important in these cases, since rapid deterioration with profound neurologic loss (and death) is the usual result in untreated cases.\textsuperscript{1,13}

The presence of fever, root pain, and localized tenderness should suggest the diagnosis. The level of suspicion should be even greater in postepidural/spinal patients—particularly if bacteremia or immunosuppression is evident.

Spinal radiographs may show evidence of a paravertebral mass, but in many cases spinal radiographs are negative for pathology. If cerebrospinal fluid (CSF) is obtained, the protein count is usually elevated (greater than 100 μg/dL), leukocytes are elevated, and glucose is usually normal.\textsuperscript{1,13}

Again, there are cases where the CSF was normal in the presence of acute symptoms.

Contrast-enhanced computerized tomography (CT) or MRI are useful diagnostic tools. But the "gold standard" for diagnosing epidural abscess continues to be myelography, which consistently shows the presence of the epidural mass or obstruction.\textsuperscript{1,13}

- **Treatment.** Although there have been a small number of cases treated successfully with antibiotics, laminectomy remains the treatment of choice for epidural abscess.\textsuperscript{1,14}

- **Outcome.** Mortality without treatment is close to 100%.\textsuperscript{1,13} The prognosis in patients undergoing laminectomy is related to the degree of neurologic impairment and (more importantly) its duration.\textsuperscript{1,13} Patients who have weakness or paralysis for less than 36 hours prior to surgery had partial to complete recovery. Patients presenting with more than 48 hours of neurologic deficit had little or no neurologic recovery.\textsuperscript{1,13,17}

### Discussion

With the high morbidity/mortality associated with an epidural abscess, it is important to consider the following factors which may contribute to an epidural infection:

- **Equipment and technique.** In 1962, Barreto found contamination in 3 of 35 lumbar epidural catheters upon removal.\textsuperscript{13} In a 1968 study by Dawkins, no thoracic or lumbar epidural infections were noted, but 8 of 3,767 (0.2%) sacral epidural blocks had infected puncture sites, resulting in one fatality from a sacral epidural abscess.\textsuperscript{13} A 1977 study of 102 epidural catheterizations had 22 positive for bacterial contamination.\textsuperscript{15} In a 1976 study of 101 epidurals placed in obstetrical patients, all catheter tips were sterile, but 5 of 101 epidural kit syringes were contaminated—probably by the anesthetist.\textsuperscript{16}

Some of these early reports of epidural infections were related to the use of reusable epidural trays.\textsuperscript{1,16} The utilization of disposable trays and micropore filters can certainly reduce the incidence of bacterial contamination.\textsuperscript{1,18} With suitable precautions (like an occlusive dressing), continuous epidural techniques can be used, even in an immersed setting, such as lithotrityp tubs.\textsuperscript{19}

- **The febrile patient.** There is a question regarding the use of epidural anesthesia on patients who are potentially bacteremic or viremic. The chance of rupturing a blood vessel while performing an epidural anesthetic varies between 1% and 10% (with the higher incidence in obstetrical patients).\textsuperscript{20,21} Therefore, performing an epidural anesthetic on a septic patient opens a potential route for infection in the epidural space. An infection at the site of epidural placement is an absolute contraindication to use of the technique. The presence of fever (and possibly sepsis) is a more relevant (and controversial) consideration for withholding an epidural.

Epidural catheter migration after placement may cause vessel erosion.\textsuperscript{22} Therefore, removal of the catheter has been advocated if the patient becomes febrile. In a 1981 study of obstetric patients, Blanco reported the incidence of bacteremia in febrile obstetrical patients as 9.7% (90.3% of the febrile patients had no bacteremia). Of the patients with positive blood cultures, 49% had temperatures below 38.8°C. In this population there was no firm relationship between fever and bacteremia.\textsuperscript{23}

There are certainly cases when an epidural anesthetic is indicated, despite the presence of fever. It is up to the prudent practitioner to weigh the potential risks versus the benefits.\textsuperscript{11,24,26}

- **Pre-existing disease.** Genital herpes (herpes simplex virus 2—HSV2) is another case in which the anesthetist is faced with the predicament of providing regional anesthesia (usually for cesarean section) versus the potential complications of meningitis and encephalitis. The safety of performing regional anesthesia on primary HSV2-infected patients has not been established. However, patients with recurrent HSV2 infections are often given epidural anesthesia with no report of septic or neurologic complications.\textsuperscript{26,28} Epidural anesthesia has also been used successfully on patients with herpes gestationis.\textsuperscript{28}

Should regional anesthesia be performed on patients with acquired immune deficiency syn-
drome (AIDS)? AIDS patients have a fairly high incidence of associated central nervous system (CNS) dysfunctions, including encephalopathy and myelopathy. Patients with serious CNS degeneration can present with paraparesis, ataxia, and incontinence. Human T-cell lymphotropic virus III (HTLV-III) has been isolated from brain tissue and CSF. In addition to HTLV-III, secondary opportunistic infections are also present.²⁰, ³¹ Again, the benefits of using a regional anesthetic must be weighed against the possibility of compromising a patient with progressive CNS disease.

- **Duration of catheter placement.** Another consideration in the use of epidural catheters is the duration of placement. The longer the catheter is left in, the greater the chance of infection, and there are recommendations of catheter discontinuation after 24-72 hours based on this premise.³², ³³ This appears to make sense on a routine basis, but there are also many cases of prolonged (weeks) epidural catheterizations without complications.²⁴, ³², ³³

**Summary**

This patient developed an epidural infection following the use of an epidural anesthetic. His symptoms included back pain and fever. An MRI noted the presence of inflammation at L-2. The infection was treated successfully with a prolonged course of IV antibiotics.

**REFERENCES**

(14) Barreto RS. Bacteriologic cultures of indwelling epidural catheters. Anesthesiology. 1942;23:643-644.
(22) Verniquet AJW. Vessel puncture with epidural catheters. Anesthesiology. 1980;56:460-462.

**AUTHOR**

Christopher C. Ferguson, CRNA, BSN, obtained his BSN degree from the University of Utah in 1976. He earned his CRNA degree through the U.S. Navy's Anesthesia Program at George Washington University, Washington, DC, in 1981. He is currently a staff CRNA at Ferguson Specialty Hospital, Grand Rapids, Michigan.
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### Crucial Parameters in Selecting a Neuromuscular Blocking Agent

<table>
<thead>
<tr>
<th></th>
<th>Norcuron&lt;sup&gt;®&lt;/sup&gt; (vecuronium bromide) for injection</th>
<th>Atracurium besylate</th>
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</thead>
<tbody>
<tr>
<td><strong>Hemodynamics</strong></td>
<td>No significant variations in blood pressure, cardiac output, or systemic vascular resistance.&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Statistically significant variations in blood pressure, cardiac output, and systemic vascular resistance.&lt;sup&gt;1&lt;/sup&gt; ($P &lt; .05$)</td>
</tr>
<tr>
<td><strong>Histamine</strong></td>
<td>Available clinical experience indicates that reactions commonly associated with histamine release are unlikely to occur.&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Precautions advised for patients in whom substantial histamine release would be hazardous (eg, clinically significant cardiovascular disease, asthma).&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Recovery</strong></td>
<td>25-40 min&lt;sup&gt;1&lt;/sup&gt; 45-65 min&lt;sup&gt;1&lt;/sup&gt;</td>
<td>35-45 min&lt;sup&gt;1&lt;/sup&gt; 60-70 min&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Dosing Flexibility</strong></td>
<td>The initial recommended dose is 0.08-0.1 mg/kg. Dose can be increased up to 0.28 mg/kg for long cases without significant histamine release or related cardiovascular side effects.&lt;sup&gt;1,2&lt;/sup&gt;</td>
<td>Initial recommended dose is 0.4-0.5 mg/kg. A moderate histamine release and significant falls in blood pressure have been seen following a dose of 0.5 mg/kg ($P &lt; .05$) and 0.6 mg/kg.&lt;sup&gt;3,4&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Storage &amp; Shelf Life</strong></td>
<td>2-year shelf life in lyophilized form at room temperature.&lt;sup&gt;1&lt;/sup&gt; Can be reconstituted with various IV solutions including Lactated Ringers.&lt;sup&gt;1&lt;/sup&gt;</td>
<td>2-year shelf life under constant refrigeration.&lt;sup&gt;1&lt;/sup&gt; Upon removal from refrigeration to room temperature storage, use within 14 days even if rerefrigerated.&lt;sup&gt;1&lt;/sup&gt;</td>
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<sup>1</sup> Dose of atracurium above 0.5 mg/kg is not recommended.

<sup>2</sup> As originally supplied by the respective manufacturers.

<sup>3</sup> Storage after reconstitution varies with solution. See package insert.
Norcuron (vecuronium bromide) for injection

Before prescribing, please consult complete product information. Norcuron* is for intravenous use only.

WARNING: Norcuron* should be administered in carefully adjusted dosage by or under the supervision of experienced clinicians who are familiar with its actions and the possible complications that may arise during its use. Use of Norcuron* in conjunction with any other direct-acting neuromuscular blocking agent is contraindicated. Norcuron* is a naturally occurring acetylcholine interaction. Norcuron* is also contraindicated in patients who have shown hypersensitivity to it.

ACTIONS:
Norcuron* is a non-depolarizing, competitive skeletal muscle relaxant that functions by direct interaction with the neuromuscular junctions in skeletal muscle. It acts on the receptor site of the terminal end plate of the neuromuscular junction, thereby preventing the release of acetylcholine and thus preventing the development of a myoneural impulse. Norcuron* has been shown to produce complete neuromuscular blockade and a significant decrease in skeletal muscle tone within 15-20 seconds of injection. The time to onset of neuromuscular blockade is 4 seconds.

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Norcuron* is well tolerated with no significant complications. The most common adverse effects associated with the use of Norcuron* are hypotension, bradycardia, and respiratory depression. These effects are usually mild and self-limiting. There have been reports of respiratory arrest, cardiac arrest, and death in rare cases. Norcuron* should be used with caution in patients with respiratory or cardiac compromise, and in patients with a history of drug overdose or suicide.

CONTRAINDICATIONS:
Norcuron* is contraindicated in patients who have shown hypersensitivity to it, those with a history of drug overdose or suicide, those with a history of drug abuse, and those with a known risk of respiratory or cardiac compromise.

PRECAUTIONS:
Norcuron* is not recommended for the management of toxemia of pregnancy. The use of Norcuron* in pregnant women should be based on consideration of the benefits to the mother which outweigh the potential risk to the fetus.

Malignant hyperthermia:
Norcuron* should be used with caution in patients with a history of malignant hyperthermia. The use of Norcuron* in patients with a history of malignant hyperthermia should be closely monitored and discontinued if signs of malignant hyperthermia occur.

Overdosage:
Norcuron* overdosage may lead to hypotension, bradycardia, respiratory depression, and even death. The treatment of Norcuron* overdosage includes supportive care, such as ventilation and intravenous fluids. If necessary, intubation and mechanical ventilation may be required.

Dosage and Administration:
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Norcuron* should be used with caution in patients with a history of drug overdose or suicide, those with a history of drug abuse, and those with a known risk of respiratory or cardiac compromise.

Storage:
Norcuron* should be stored at room temperature or refrigerated. Do not freeze. The solution should be discarded if it appears cloudy, discolored, or contains particulate matter.

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Significantly improved speed and quality of recovery compared with thiopental/isoflurane

<table>
<thead>
<tr>
<th>Mean postanesthesia recovery times (min)⁴</th>
<th>DIPRIVAN</th>
<th>Thiopental/isoflurane</th>
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<tbody>
<tr>
<td>Duration of anesthesia</td>
<td>85*</td>
<td>57</td>
</tr>
<tr>
<td>Response to commands</td>
<td>3.5*</td>
<td>6.1</td>
</tr>
<tr>
<td>Fully oriented</td>
<td>5.5</td>
<td>9.4</td>
</tr>
<tr>
<td>Able to tolerate fluids</td>
<td>61*</td>
<td>130</td>
</tr>
<tr>
<td>&quot;Ready&quot; for discharge</td>
<td>138*</td>
<td>206</td>
</tr>
</tbody>
</table>

*Statistically significant (*P* < .05).
Measurements taken from time of discontinuation of all maintenance anesthesia.

Majority of patients are generally awake, responsive, and oriented within 8 minutes
recovery and anesthetic control

Significantly less nausea and vomiting than with thiopental/isoflurane

<table>
<thead>
<tr>
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<th>DIPRIVAN (n = 20)</th>
<th>Thiopental/isoflurane (n = 20)</th>
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<tbody>
<tr>
<td>Nausea/vomiting</td>
<td>20%</td>
<td>65%</td>
</tr>
<tr>
<td>Sung et al</td>
<td>(n = 49)</td>
<td>(n = 50)</td>
</tr>
<tr>
<td>Nausea/vomiting</td>
<td>8.1%</td>
<td>30%</td>
</tr>
</tbody>
</table>

As part of a balanced anesthetic technique, DIPRIVAN is a cost-effective alternative to thiopental/isoflurane for induction and maintenance.

Please see last pages of this advertisement for brief summary of prescribing information.
Maintenance of anesthesia as easily controlled as with isoflurane

- Steady state blood concentrations are proportional to rate of administration

![Graph showing maintenance of anesthesia by continuous infusion](image)

- Total body clearance exceeds estimates of hepatic blood flow

- No active metabolites produced

---adapted from Herregods et al, p 364* 

*Significant difference (P < .05) from previous value.

** P < .02. (Mean and SEM values are shown.)

After a loading dose of 2 mg/kg, anesthesia was maintained with 150 µg/kg/min for 30 minutes—then 100 µg/kg/min for 90 minutes.

As with most anesthetic agents, clearance rate of DIPRIVAN decreases in elderly patients.
Hemodynamic effects are controllable and dose-dependent

- Blood pressure (BP) predictably decreases on induction (sometimes > 30%) but is within acceptable ranges for healthy individuals*

- Hemodynamic effects during induction are generally more pronounced than with traditional IV induction agents

After initial decreases in BP following induction, hemodynamics return toward baseline

The cardiovascular effects of DIPRIVAN may be increased in patients who have received sedative or narcotic premedications.¹

DIPRIVAN is not a narcotic agent
When used with N₂O/O₂ for maintenance, supplementation with IV analgesic agents is generally required; muscle relaxants may also be required.

Strict aseptic techniques must always be maintained while handling DIPRIVAN. DIPRIVAN is a single-use parenteral product and contains no antimicrobial preservatives. DIPRIVAN Injection should be prepared for use just prior to initiation of each individual anesthetic procedure. DIPRIVAN injection should be drawn into sterile syringes immediately after ampules are opened. Administration should commence promptly and be completed within 6 hours after the ampules have been opened.

* Elderly, debilitated, and/or hypovolemic patients, and those rated ASA III/IV, may have more profound adverse cardiovascular responses.
¹ Induction dose requirements may be reduced.

Please see last pages of this advertisement for brief summary of prescribing information.
Superior recovery and exceptional anesthetic control

As part of a balanced anesthetic technique, DIPRIVAN is a cost-effective alternative to thiopental/isoflurane for induction and maintenance.

- Significantly improved speed and quality of recovery compared with thiopental/isoflurane
- Significantly less nausea and vomiting than with thiopental/isoflurane
- As convenient and as easily controlled as isoflurane for maintenance of anesthesia

References:

Please see last pages of this advertisement for brief summary of prescribing information.
DIPRIVAN® (propofol) injection

EMERGENCE FROM IV ADMINISTRATION

The induction dose requirements of DIPRIVAN® injection may be reduced in patients with intracranial hypertension, particularly those with severe head injury or structural lesions of the brain. Patients requiring minimized or reduced maintenance of anesthesia should be monitored closely for signs of awareness.

Maintenance of Anesthesia

Anesthesia can be maintained by administering DIPRIVAN® injection or by infusion of smaller bolus doses every 30 minutes. The most common adverse events occurred in more than 90% of patients receiving DIPRIVAN® injection for maintenance of anesthesia. These included hypotension, bradycardia, pain at the infusion site, and changes in heart rate and blood pressure. Other adverse events reported included respiratory depression, respiratory arrest, cardiac dysfunction, and hypothermia.

Induction of Anesthesia

Induction with DIPRIVAN® injection may be accomplished with a bolus dose of 2 mg/kg and additional increments of 1 to 2 mg/kg may be used. The duration of induction is generally less than 10 minutes. When induction is followed by maintenance with a propofol infusion, patients may experience hypotension, bradycardia, and respiratory depression. Patients should be closely monitored for signs of awareness and alcohol withdrawal syndrome may occur.

The incidence of nausea and vomiting following DIPRIVAN® injection administration is typically less than 5% and is self-limiting. Non-pharmacological interventions such as positioning, use of a pressure dressing, and the application of topical anesthetic agents may be useful to minimize pain and discomfort at the site of injection.

DIPRIVAN® injection may be administered intravenously over intermittent bolus doses or by continuous infusion. With the use of an infusion pump, patients may experience respiratory depression, as well as hypotension and bradycardia. These adverse effects may be prevented by titrating the infusion rate downward in the absence of clinical signs of respiratory depression.

Patients receiving DIPRIVAN® injection by infusion should be closely monitored for signs of respiratory depression, and the incidence of adverse events may be decreased by using a variety of techniques, including the use of a non-invasive respiratory monitor, and the use of anesthetic agents such as fentanyl.

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DIPRIVAN® injection may be administered intravenously over intermittent bolus doses or by continuous infusion. With the use of an infusion pump, patients may experience respiratory depression, as well as hypotension and bradycardia. These adverse effects may be prevented by titrating the infusion rate downward in the absence of clinical signs of respiratory depression.

Patients receiving DIPRIVAN® injection by infusion should be closely monitored for signs of respiratory depression, and the incidence of adverse events may be decreased by using a variety of techniques, including the use of a non-invasive respiratory monitor, and the use of anesthetic agents such as fentanyl.

Maintenance of Anesthesia

Anesthesia can be maintained by administering DIPRIVAN® injection or by infusion of smaller bolus doses every 30 minutes. The most common adverse events occurred in more than 90% of patients receiving DIPRIVAN® injection for maintenance of anesthesia. These included hypotension, bradycardia, pain at the infusion site, and changes in heart rate and blood pressure. Other adverse events reported included respiratory depression, respiratory arrest, cardiac dysfunction, and hypothermia.

Induction of Anesthesia

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PAS freelancer Carroll Ellis Ruhlman enjoys horseback riding, hiking and even sky diving! She also relishes the delight of discovering new places and new people when she is freelancing. “PAS takes care of all the details so I can orchestrate my life to suit me,” says Carroll.

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