Abstract

Background: Ideal anesthetic technique for renal allograft recipients should provide hemodynamic stability, optimum graft reperfusion and adequate analgesia. Balanced anesthesia is preferred because renal nociception is conducted multi-segmentally and chronically ill ESRD patients have labile psychological profile. Present study compared the efficacy of dexmedetomidine with fentanyl administered via intravenous and epidural route before induction of general anesthesia.

Methods: Prospective, double blind randomized study, recruited sixty hemo-dynamically stable ESRD adults, 18-55 years, scheduled for elective live related renal transplantation. Patients randomly received intravenous dexmedetomidine 0.5 µg/kg followed by epidural dexmedetomidine 0.5 µg/kg alongwith 5ml;0.25% ropivacaine or intravenous fentanyl 1 µg/kg followed by epiduralfentanyl 1 µg/kg alongwith 5ml;0.25% ropivacaine. All patients received standardized general anaesthesia and continuous epidural ropivacaine 0.25%; 4-8 ml/hr. Preoperative sedation, peri-operative haemodynamics, end tidal anaesthetic agent requirement, peri-operative fluid requirement, need for vasopressors, blood loss and early graft function was assessed.

Results: 80% patients receiving intravenous dexmedetomidine did not require rescue midazolam for achieving satisfactory sedation before induction of general anaesthesia. Dexmedetomidine significantly reduced propofol and end tidal inhalational agents requirement and need for rescue analgesics. Early renal graft function (onset time of diuresis after declamping, 24 hours urine output and serum creatinine levels) was comparable. There were no adverse sequelae.

Conclusion: Dexmedetomidine-based anaesthetic regimen versus fentanyl-based anaesthesia provided appropriate anxiolysis and analgesia for conducting invasive procedures and subsequent epidural administration of these agents reduced anaesthetic requirement and prolonged postoperative analgesia without compromising hemodynamics and respiratory parameters. Further dose finding studies can be conducted in kidney transplant recipients.

Peri-operative management of renal allograft recipient should assure hemodynamic stability,
enhance graft reperfusion and provide good post-operative pain relief\(^1\). Every effort is made to choose the right techniques as well as pharmacological agents which facilitate proper functioning of the newly transplanted organ\(^2\,^3\). Combined general and regional anesthesia has been preferred considering that renal nociception is conducted multi-segmentally and chronically ill ESRD patients have labile psychological profile\(^4\,^7\). Epidural anesthesia provides dynamic pain relief, permits early extubation and a better response to the stress of anesthesia and surgery. However, large volumes of local anesthetics (LA) administered via neuraxial route can have deleterious hemodynamic consequences with associated risk of LA toxicity. Although, Ropivacaine has low risk of cardiovascular and central nervous system toxicity and a lesser propensity for motor blockade\(^8\). Traditionally, opioids have been used as neuraxial adjuvants to reduce the dose of local anesthetics and improve the quality of peri-operative analgesia\(^9\). However, there is always a possibility of urinary retention, nausea, vomiting, pruritis and respiratory depression with these agents\(^10\). The incidence of motor blockade after epidural analgesia with amide local anesthetics (LA) and opioids is approximately 4-12%, which defeats the novel purpose of appropriate pain relief\(^9\).

**Dexmedetomidine**, an \(\alpha_2\)-adrenergic agonist has sedative, anxiolytic, and anesthetic sparing properties. The anti-nociceptive properties of the drug has been demonstrated in various trials where it was administered via systemic, intrathecal, perineural or intra-articular routes\(^11\,^15\). Compared to fentanyl, dexmedetomidine has been reported to induce sedation without affecting the respiratory status. However, efficacy of dexmedetomidine in renal transplant surgery has not been evaluated. Therefore, the present study was planned to compare dexmedetomidine and fentanyl administered via both intravenous and epidural route prior to induction of anesthesia.

Our hypothesis is that preinduction intravenous dexmedetomidine infusion will provide anxiolysis and analgesia for central venous line and epidural catheter insertions and its subsequent administration via epidural route alongwith ropivacaine will reduce intraoperative anesthetic requirement and prolong postoperative analgesia without compromising respiratory parameters in end-stage renal disease patients undergoing live-related kidney transplant surgery.

**Methods**

This prospective, double blind randomized trial, enrolled sixty ASA physical status II or III adults, either gender, 18-55 years suffering from end stage renal disease. Research ethics committee approval and informed written consent was taken. Patients with drug allergy, compensated/decompensated myocardial insufficiencies, coagulation abnormalities or accidental dural puncture were excluded. Premedication consisted of oral alprazolam 0.25 mg and ranitidine 150 mg administered the night before surgery. Preoperative monitoring included: electrocardiography (ECG), baseline heart rate, respiratory rate, noninvasive blood pressure (NIBP), arterial oxygen saturation (SpO\(_2\)), and bispectral index (BIS). The mean of first three recordings of hemodynamic parameters at 5 min interval taken after the patient was shifted to the operation theatre were considered as the baseline values. A 16 G cannula was secured in a peripheral vein normal and saline infusion was started at 2 ml/kg/hour. The limb with arterio-venous fistula was not used for peripheral venous access and invasive pressure monitoring.

Patients were randomized using computer generated permuted block into two groups (randomized blocks of 6 patients in a 1:1 ratio using sealed envelopes). Group F patients (n=30) received 1 µg/kg fentanyl infusion diluted to 20ml intravenous fluid over 10 minutes before induction of anesthesia and 1 µg/kg fentanyl in combination with 5ml of 0.25% ropivacaine (total volume 8ml ) via epidural route after insertion of epidural catheter. Group D patients (n = 30) received 0.5 µg/kg dexmedetomidine infusion diluted to 20 ml intravenous solution over 10 minutes before induction of anesthesia and 1 µg/kg fentanyl in combination with 5ml of 0.25% ropivacaine by epidural route (total volume 8 ml).

A 20 G arterial canula was inserted in the radial artery under local infiltration for continuous blood pressure monitoring. A double lumen central venous catheter was inserted in to internal jugular
vein (IJV) under local infiltration. Subsequently, under aseptic precaution 18G epidural catheter was placed in T12-L1 space with patient in left lateral position. Correct placement of catheter was confirmed by injecting epidural test dose (3ml 2% lignocaine with adrenaline 5µg/ml). The epidural study solutions were prepared by an uninvolved anesthesiologist according to written instructions on sealed envelopes. The solution (8ml) was infused over 10 minutes via epidural route. This was followed by maintenance infusion of 0.2% ropivacaine at 4ml-8ml/hr administered epidurally.

Hypotension was defined as systolic blood pressure (SBP) <90 mmHg or a greater than 20% drop in mean arterial pressure (MAP) and managed with intravenous fluid administration to maintain CVP 12-15 mmHg. If MAP remained low despite adequate fluid infusion, vasoconstrictor (mephenteramine 3-6 mg intravenous boluses) or ionotropic support was instituted to maintain hemodynamic parameters within 20% of the baseline values.

General anesthetic technique consisted of intravenous propofol, atracurium and a mixture of O₂, N₂O and isoflurane titrated to BIS value between 40-60. Endotracheal intubation was facilitated by IV atracurium 0.5 mg/kg when TOF count was zero. After intubation, intermittent positive pressure ventilation was commenced with a mixture of 50% nitrous oxide in oxygen and isoflurane, using a closed circuit with a circle absorber. Ventilation was adjusted to maintain end-tidal carbon dioxide (EtCO₂) between 35-40mm Hg. A TOF count of 2 or more was an indication for giving atracurium 0.1mg/kg IV. Total dose of atracurium consumption was noted. In all the patients, CVP was gradually build up to 15 mmHg by crystalloids up to 50 ml/kg and colloids (2-4 ml/kg; 20% albumin) until revascularization. Intravenous frusemide 2 mg/kg, hydrocortisone 10 mg/kg and 20% mannitol 2 ml/kg was given to all patients before reperfusion of grafted kidney. Target hemodynamics of mean BP> 85 mmHg, systolic BP > 135 mm of Hg and CVP of 12-15 mm of Hg were maintained during and after declamping. Blood transfusion was considered according to hemodynamic parameters, estimated blood loss and serum hemoglobin levels.

In case of poor graft function (no urine output) fluid administration was restricted. The total dose of vasoconstrictors/ ionotropes used to maintain perioperative hemodynamics were noted. Intravenous ondansetron (0.1 mg/kg) was administered half an hour before the expected time of completion of the surgery. At end of surgery patient was reversed with neostigmine (0.05 mg/kg) and atropine (0.02 mg/kg)/ glycopyrolate (0.01 mg/kg) and extubated on meeting the standard criteria for extubation. They were shifted to post renal transplant care unit as per the institutional protocol where hourly hemodynamic parameters were recorded for 24 hrs. For postoperative pain relief, 4-8 ml/hr of 0.2% ropivacaine infusion was used. If VAS was >4, first rescue analgesic with intravenous tramadol 50 mg was used. For the patients not relieved with IV tramadol morphine 3mg was given.

The level of sedation was assessed by the Modified Observers Assessment of Alertness/Sedation Score (OAA/S)¹⁶. The intensity of pain (assessed by a linear Visual Analog Scale)¹⁷ and BIS values were noted every 5 minutes till the induction of anesthesia. Dose of intravenous propofol needed for loss of consciousness was also noted.

Statistical Analysis

ANOVA with post-hoc significance, Chi-square test and Fisher’s exact test were used as appropriate. Value of $P<0.05$ was considered significant and $P<0.001$ as highly significant. The sample size was calculated based on previous study⁷ employing epidural anesthesia with local anesthetic for renal transplant surgery. To detect a 50% decrease in the incidence of rescue analgesic requirement a minimum of 28 patients per group were required to ensure adequate power of the study with $\alpha$ of 0.05 (confidence interval 95%) and $\beta$ of 0.1 (power of 90%).

Results

The demographic profile of both groups was comparable (Table 1). The baseline hemodynamic parameters were comparable in both the groups. Observers Assessment of Alertness and Sedation
### Table 1
The demographic profile of all the patients

<table>
<thead>
<tr>
<th>THE DEMOGRAPHIC Data</th>
<th>GROUP D (n=30)</th>
<th>GROUP F (n=30)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Yrs)</td>
<td>34.33±9.77</td>
<td>35.80±10.35</td>
<td>0.579</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>162.10±7.298</td>
<td>160.93±7.315</td>
<td>0.539</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>55.04±7.55</td>
<td>53.083±9.05</td>
<td>0.366</td>
</tr>
<tr>
<td>Gender (M:F)*</td>
<td>25:5</td>
<td>22:8</td>
<td>0.387</td>
</tr>
<tr>
<td>Wt Before HD</td>
<td>56.583±7.76</td>
<td>54.58±9.04</td>
<td>0.362</td>
</tr>
<tr>
<td>Wt After HD</td>
<td>55.04±7.55</td>
<td>53.083±9.05</td>
<td>0.366</td>
</tr>
<tr>
<td>Preoperative Creatinine (mg/dl)</td>
<td>6.13 ± 1.74</td>
<td>6.74 ± 1.16</td>
<td>0.15</td>
</tr>
<tr>
<td>Preoperative GFR (ml/min)</td>
<td>11.93 ± 5.51</td>
<td>9.93 ± 1.99</td>
<td>0.14</td>
</tr>
</tbody>
</table>

### Table 2
Perioperative characteristics of the patients of both the groups

<table>
<thead>
<tr>
<th>PERIOPERATIVE CHARACTERISTICS</th>
<th>GROUP D (n=30)</th>
<th>GROUP F (n=30)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm ischemia time (min)</td>
<td>24.50±3.149</td>
<td>23.50±2.991</td>
<td>0.212</td>
</tr>
<tr>
<td>Cold ischemia time (min)</td>
<td>82.53±7.026</td>
<td>79.97±9.223</td>
<td>0.230</td>
</tr>
<tr>
<td>Time of onset of diuresis declamping (min)</td>
<td>5.44 ± 1.40</td>
<td>5.53 ± 1.53</td>
<td>0.972</td>
</tr>
<tr>
<td>Total dose of Propofol for induction (mg)</td>
<td>64.00±12.205</td>
<td>82.50±19.77</td>
<td>0.000*</td>
</tr>
<tr>
<td>Total dose of Atracurium (mg)</td>
<td>84.00±13.15</td>
<td>89.50±11.91</td>
<td>0.095</td>
</tr>
<tr>
<td>Total dose of Fentanyl (µg)</td>
<td>60.80±9.54</td>
<td>92.00±21.21</td>
<td>0.01*</td>
</tr>
<tr>
<td>Blood loss (ml)</td>
<td>255.00±56.24</td>
<td>263.33±54.03</td>
<td>0.561</td>
</tr>
<tr>
<td>Crystalloids (ml/kg)</td>
<td>2500.00±435.494</td>
<td>2513±450.178</td>
<td>0.905</td>
</tr>
<tr>
<td>Albumin (ml/kg)</td>
<td>198.33±20.692</td>
<td>186.67±34.575</td>
<td>0.118</td>
</tr>
<tr>
<td>Duration of surgery (min)</td>
<td>121.33±10.41</td>
<td>125.33±11.66</td>
<td>0.279</td>
</tr>
<tr>
<td>Duration of anesthesia (min)</td>
<td>191.33±13.83</td>
<td>190.67±12.61</td>
<td>0.458</td>
</tr>
<tr>
<td>Time to 1st Rescue analgesia</td>
<td>13(10-16)</td>
<td>4(3-5)</td>
<td>0.001*</td>
</tr>
<tr>
<td>Post op Tramadol (mg)</td>
<td>11.67±21.50</td>
<td>50.00±22.74</td>
<td>0.000*</td>
</tr>
<tr>
<td>Post op Morphine (mg)</td>
<td>0.30±0.915</td>
<td>5.30±8.991</td>
<td>0.004*</td>
</tr>
<tr>
<td>Post surgery Urea (mg/dl)</td>
<td>60.07±19.59</td>
<td>72.91±33.34</td>
<td>0.075</td>
</tr>
<tr>
<td>Post surgery Creatinine (mg/dl)</td>
<td>3.718±1.38</td>
<td>4.843±2.305</td>
<td>0.060</td>
</tr>
<tr>
<td>Post operative Nausea</td>
<td>5 (16%)</td>
<td>4 (13%)</td>
<td>0.784</td>
</tr>
<tr>
<td>Postoperative Vomiting</td>
<td>4 (13%)</td>
<td>3 (10%)</td>
<td>0.673</td>
</tr>
<tr>
<td>Postoperative Shivering</td>
<td>1 (3.3%)</td>
<td>1 (3.3%)</td>
<td>1.000</td>
</tr>
<tr>
<td>Postoperative Headache</td>
<td>1 (3.3%)</td>
<td>0</td>
<td>0.554</td>
</tr>
</tbody>
</table>
Score noted at 5 minutes interval for 30 minutes after giving the intravenous drug in both the groups. OAAS of 4 was achieved in 25 patients in Group D after 10 minutes. However, in Group F only 4 patients achieved OAAS of 4. The Rest of the patients required injection of midazolam (1 mg iv). Between groups OAAS was significantly better in group D versus group F (p<0.05).

Induction dose of propofol for hypnosis and achieving BIS value 40 – 60, was significantly lower in Group D as compared to Group F (p<0.05). EtAA requirement was significantly lower in Group D as compared to Group F (p<0.05).

A total 27 patients in Group F received injection tramadol as compared to only 8 patients in Group D for V AS > 4. In Group F, 18 patients received injection morphine as second rescue analgesic versus 4 patients in Group D (p<0.05). Time for maintaining adequate analgesia without the need for tramadol was significantly longer in group D.

Early graft function was assessed by onset of diuresis after declamping, hourly urine output, serum creatinine levels and glomerular filtration rate (GFR) estimation in the first 24 hours. Values were comparable in both the groups (p > 0.05). Both the groups did not differ in terms of post operative nausea, vomiting, shivering and headache. Patients in both the groups received epidural infusion of 0.2% of ropivacaine at the rate of 4-8ml/hr in the post operative period. The epidural catheter was removed when VAS was consistently less than 4 for 12 hours. All the patients were discharged from the transplant unit on the 6th or 7th postoperative day. There were no readmissions.

Discussion

In the present study, combination of general anesthesia alongwith continuous epidural ropivacaine infusion was used for live-related renal transplant surgery. We also used a fixed dose of two different adjuvants ie fentanyl versus dexmedetomidine via intravenous and epidural routes prior to induction of general anaesthesia. Both these adjuvants alongwith standard anaesthesia, provided stable hemodynamics and optimum intraoperative analgesia. Considering frequent reports of labile hemodynamic profile of ESRD patients18-20, fixed and relatively lower doses of these two study drugs were chosen. For the same reasons, variable rate local anesthetic epidural infusion was administered perioperatively ie 0.25% ropivacaine at 4-8 ml/hour to titrate MAP within 20% of the baseline values. Both the anesthetic regimens provided satisfactory anesthesia, but dexmedetomidine group proved to be a better alternative with less requirement of intraoperative anaesthetic agents and postoperative rescue analgesics.

ESRD patients frequently have marked swings in BP during surgery (±30%) and exaggerated responses to induction, laryngoscopy, intubation, declamping and extubation21. This is because of preoperative dialysis induced dehydration, increased sensitivity to anesthetics and/or long-term usage of anti hypertensives. Therefore, a concern about haemodynamic instability has been raised when general anaesthesia is administered alongwith central neuraxial blockade18. In previous studies, prophylactic low dose dopamine infusion has been used to maintain perfusion pressure of the grafted kidney. Bhosale et al22 reported 6% incidence of hypotension in their prospective study involving CSEA in renal transplant surgery. Dauri et al23 compared combined general and epidural anaesthesia with general anaesthesia. No case of hypotension was reported though the dopamine infusion rate required to maintain perfusion pressure was higher in the combined group. Akpek et al5 started dopamine infusion soon after the epidural drug was administered to maintain adequate perfusion pressures. This may be the reason that no case of hypotension was reported.

Literature reveals that high vasoressor support required for the maintainence of perioperative haemodynamics can adversely affect micro circulation of the grafted kidney19,20. Therefore, it has been commented that vasoconstrictors with strong α-adrenergic effects, such as phenylephrine, should be drugs of last resort. Several animal models have also demonstrated that vessels in the transplanted organs are more sensitive to sympathomimetics24,25. Therefore, it is worthwhile to find out ideal anesthetic regimens. Low dose epidural ropivacaine is being preferred because it is less cardiotoxic, provides better analgesia without motor blockade. Addition of neuraxial adjuvants like opioids and alpha-2 receptor agonists. 

M.E.J. ANESTH 22 (6), 2014
further improve the quality of peri-operative analgesia due to sedative, anxiolytic, and local anesthetic sparing properties. Asano T et al. observed in an animal study that anti-nociceptive efficacy of epidural dexmedetomidine is approximately five times more compared to its systemic administration. Salgado P et al. found that epidural dexmedetomidine does not affect onset time or upper level of anesthesia (p > 0.05) moreover it prolongs block duration time (p < 0.05) and postoperative analgesia (p < 0.05), and also results in a more intense analgesia (p < 0.05). Superiority of epidural dexmedetomidine has been proved in an orthopedic study. These findings were confirmed in the present study in ESRD patients. Kasaba et al. observed that hypotensive effects of propofol are additive to epidural anaesthesia, resulting in significant decrease in MAP. Ngwenyama N et al. has commented that concomitant use of intravenous dexmedetomidine in patients undergoing spinal fusion surgery reduced propofol infusion requirements with less effect on hemodynamics. We also observed that induction dose of propofol required in Group D was significantly lower as compared to Group F. Intraoperative EtAA requirement for maintaining BIS value within 40-60 was also lower in Group D.

All the graft recipients received adequate hydration to maintain CVP of 12-15mm of Hg. Intraoperative fluid requirements (crystalloid and colloid) to maintain CVP was comparable in both the groups. Carlier and Luciani et al. The authors have emphasize upon the importance of maximal hydration and maintenance of adequate haemodynamic parameters at the time of reperfusion for the development of early diuresis and prophylaxis of acute tubular necrosis in the immediate postoperative period. Kadijeva et al. reported that maintenance of perfusion pressure by generous administration of intravenous fluids to permit adequate renal blood flow was more important than
perioperative dopamine infusion in achieving graft function and survival. During declamping there is a release of acid metabolites, prostaglandins, activated complements, cold perfusate of grafted kidney and myocardial depressant factor\textsuperscript{35}. After eclamping the MAP decreased in all the patients. However, the fall was not significant in both the groups. Akpek et al\textsuperscript{36} in their prospective study comparing general anaesthesia and epidural anaesthesia for renal transplant recipients found no difference in the immediate postoperative graft function as determined by biochemical markers and DTPA scan. Early graft function was assessed by onset of diuresis after declamping, post operative serum creatinine and urine output estimation at hourly intervals for first twenty four hours. These parameters were comparable in both the study groups. Warm and cold ischaemic time and time of onset of diuresis was comparable in both the groups. The estimated blood loss didnot differ amongst groups. Postoperatively analgesia as assessed using visual analogue scale (VAS) scores revealed longer and better pain relief in Group D. None of the patients had adverse effects related to the study drugs, anaesthetics used or surgery. Opioid related urinary retention, pruritis, or respiratory depression did not occur with the dose of fentanyl used. Undue bradycardia did not occur with the single dose dexmedetomidineadministered via parenteral and epidural route. None of the patients had any cardiovascular or neurological side effects due to local anaesthetics. There was no accidental dural puncture, There was no case of epidural hematoma, neurological deficits, hyperacute graft rejection, excessive bleeding, anuria, injury to bowel or other vascular structures.

Considering the paucity of published data in ESRD patients, we preferred to use fixed single dose of dexmedetomidine and infusion was not continued intraoperatively or postoperatively. Frumento\textsuperscript{37} et al found that dexmedetomidine infusion administered as a supplement to epidural analgesia induces diuresis in post-thoracotomy patients with normal preoperative renal function and undergoing fluid restriction. In the

\textbf{Fig. 2}

\textit{Peri-operative Hemodynamics, Preoperative Sedation Scores Intra-operative Anesthetic Agent Requirement Data}
provided appropriate anxiolysis and analgesia for conducting invasive procedures and subsequent epidural administration of these agents reduced anaesthetic requirement and prolonged postoperative analgesia without compromising hemodynamics and respiratory parameters. Further dose finding studies can be conducted in kidney transplant recipients.

To conclude, dexmedetomidine-based anaesthetic regimen versus fentanyl-based anaesthesia in the present study, single dose of dexmedetomine was used and no such beneficial effects were noticed. Further studies can be conducted in renal transplant recipients to demonstrate this effect of dexmedetomidine on the grafted kidney.

Fig. 3
Postoperative Pain VAS scores
References

The key to

Lock-up

Postoperative Pain

STEP I

Initial bolus

Inject 1 ampoule Tramal® 100 mg i.v. or i.m. slowly over 2-3 minutes

Ways of administration after initial bolus

Infusion

Inject 3 ampoules Tramal®, each 100 mg, in 500ml infusion solution. Infusion rate 12-24 mg Tramal®/h (16-20 drop/min or 30-60 ml/h).

PCAt

Subsequent increments of 26 mg with a lock-out time of 5 minutes. Usually 30 mg or 100 mg 14 hours up to a total daily dose of 400 mg. Further treatment with Tramal® bolus on demand.

If needed further doses of Tramal® 50 mg up to a total of 200 mg (excluding the initial bolus) within the first 60 min.

STEP II

Follow-up

1-2 capsules every 4-6 hours

50 mg every 4-6 hours

20-40 drops every 4-6 hours

100 mg 1 suppository every 4-6 hours

STEP III

Intra-Operative

Loading Dose

2.5 - 3 mg/kg at wound closure

Loading Dose of Tramal® will reduce PONV rates

Loading Dose

If intra-operative dose not given then

BOLUS I.V.*

100 mg over 2-3 mins

Post-Anaesthesia Care Unit

*If needed further doses of 50 mg up to a total of 200 mg (incl. the initial bolus) may be given within the first 60 min.

For patients with localized BURNING, SHOOTING, STABBING, Neuropathic pain

VERSATIS® 5% lidocaine medicated plaster
WORKS WHERE IT HURTS

GRUNENTHAL
BRIDION—optimal neuromuscular blockade management and improved recovery

Predictable and complete reversal

- 98% of BRIDION patients recovered to a TOF ratio of 0.9 from reappearance of T_2 in 5 minutes
- 97% of BRIDION patients recovered to a TOF ratio of 0.9 from 1 to 2 PTCs within 5 minutes

Rapid reversal

- BRIDION rapidly reversed patients from reappearance of T_2 in 1.4 minutes
- BRIDION rapidly reversed patients from 1 to 2 PTCs in 2.7 minutes

BRIDION is indicated for the reversal of neuromuscular blockade induced by rocuronium or vecuronium. In children and adolescents (aged 2-17 years), BRIDION is only recommended for routine reversal of moderate rocuronium-induced neuromuscular blockade.

Important safety information

BRIDION is contraindicated in patients with severe renal impairment. Studies in patients with hepatic impairment have not been conducted and, therefore, patients with severe hepatic impairment should be treated with caution. BRIDION is contraindicated in patients with a history of hypersensitivity to benzyl alcohol or propylene glycol. BRIDION is contraindicated in patients with a history of cardiovascular, respiratory, or central nervous system disorders.BRIDION is contraindicated in patients with a history of cardiovascular, respiratory, or central nervous system disorders.

References

1. BRIDION Summary of Product Characteristics (MPC)

Please see summary of product characteristics for full prescribing information.
Pioneering Medical Technology

TAP Block And InfiltraLong
For Effective Treatment
Of Long And Deep Incisions

Sono Cannulas
For Single Shot UltraSound
Guided Nerve Blocks

SonoSystem And SonoLong Curl
For UltraSound Guided Nerve Blocks

Sprotte® 2.G
The New Generation
Dura Punctre In Minimum Time

SonoEye Ophtalmic Block
For Peribulbar And Retrobulbar
Blocks Under Ultrasonic Monitoring

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