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COMBINED SPINAL-EPIDURAL ANAESTHESIA (CSEA) FOR RENAL TRANSPLANTATION

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ABBREVIATIONS

CSEA	Combined spinal epidural anaesthesia	CVP	Central venous pressure
EA	Epidural anaesthesia	ECG	Electrocardiogram
NIBP	Non-invasive blood pressure	SA	Spinal anaesthesia
VAS	Visual analogue score		

KEY WORDS

renal transplantation, combined spinal-epidural anaesthesia, buprenorphine

ABSTRACT

Appropriate anaesthesia for renal transplantation requires maintenance of vital functions with minimal toxicity to the patient and graft besides optimal pain relief. Combined spinal-epidural anaesthesia (CSEA) was selected in 468 patients undergoing renal transplantation surgery to evaluate effectiveness and safety of the technique. Inj. Bupivacaine 3.0 ml was given intrathecally and inj. Lignocaine (2 %) with adrenaline (1:200000) and bupivacaine (0.5%) were used for epidural block. The onset of block, level of block, hemodynamic changes and perioperative complications were observed. Inj. Buprenorphine was given through epidural catheter for postoperative pain relief. CSEA seems to be a logical choice for renal transplantation due to its lower toxicity, stable intraoperative haemodynamics and smooth postoperative recovery.

INTRODUCTION

Renal transplantation is the preferred therapeutic option for patients with end-stage renal disease compared to dialysis. The associated medical problems which concern anaesthetic management are anaemia, uncontrolled hypertension, diabetes, generalized atherosclerosis, acid-base and fluid-electrolyte imbalance, bleeding disorders and susceptibility to infections. End-stage renal disease also increases the risk of ischemic heart disease and poor anaesthetic outcome. Successful anaesthetic care of these patients remains a challenge for anaesthesiologists.

The initial report on anesthesia for renal transplantation came from the Peter Bent Brigham Hospital in 1962. Leroy Vandam suggested continuous spinal anesthesia (SA) for this lower abdominal extra-peritoneal surgery, providing adequate surgical field with good muscle relaxation[1]. Gordon Wyant also reported his experience at the beginning of his series of renal transplantation and concluded that regional technique

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offered the best solution[2]. With improvement in clinical condition of patients with hemodialysis, availability of new short-acting anaesthetic drugs and disposable anaesthetic equipments, general anesthesia became the technique of choice for renal transplantation. However, there always remains a possibility of iatrogenic pulmonary infection from intubation and prolonged action of anaesthetic drugs as pharmacodynamics and pharmacokinetics of many drugs are altered in patients with renal failure. To avoid the problems of general anaesthesia, we selected combined spinal epidural anaesthesia (CSEA) for renal allograft recipients with particular reference to cardiovascular stability, patients' and surgeons' acceptance and complications.

MATERIAL AND METHODS

Four hundred and sixty eight patients undergoing renal transplantation from August 2000 to December 2004 at the Institute of Transplantation Sciences, Ahmedabad were included in this study of CSEA after their informed consent. Patients having peripheral neuropathy or myopathy, ejection fraction < 35 % on echocardiography, spine deformity or altered coagulation profile preoperatively were excluded from the study. Thorough pre-anaesthetic checkup with all baseline and specific investigations were carried out. Patients were explained the anaesthetic procedure in details and every effort was made to reduce their apprehension and fear by answering their queries. Associated medical problems were brought under reasonable control with drugs and all patients were hemodialysed within 24 hours of surgery. Blood biochemistry, serum electrolytes and ECG were obtained before surgery.

Long-term medications like anti-hypertensives, anti-anginals, anti-convulsants and anti-arrhythmics were continued until the time of surgery. All patients received Tab. Diazepam, 0.2 mg/kg BW orally on the previous night of surgery. On the operation table, after securing vein with 18 G cannula, patients were premedicated with Inj. Midazolam 2 mg IV. Inj. Ondansetran, 8 mg IV and Inj. Ranitidine, 50 mg IV were given to reduce aspiration risk. No preloading was done.

After applying ECG, SpO2 and NIBP, right internal jugular vein was cannulated and central venous pressure (CVP) was measured. Epidural space was identified by 18 G Toughy needle at L1-L2 or L2-L3 space by loss of resistance technique in right lateral position under aseptic precautions. An epidural catheter was introduced and about 7-10 cm catheter was left in the epidural space. Lignocaine (2 %) with adrenaline (1:200000), 3 cc was given as a test dose. Subarachnoid space was located with 23/ 25 G spinal needle one space below the epidural space and Bupivacaine (heavy) 0.5%, 3 cc was injected. The onset of action and maximum level of anaesthesia were recorded. After one and half hour of spinal dose, mixture of inj. Bupivacaine (0.5%) 7ml and Inj. Lignocaine (2%) with adrenaline (1:200000) 7 ml, was given through epidural catheter. Continuous anaesthesia was maintained by repeating one-third of the initial dose of mixture at regular intervals of 1.5 hours without waiting for the effect of the previous dose to wear off. Total dose of Bupivacaine and Lignocaine with adrenaline were recorded. Supplemental oxygen was given to all patients through nasal cannula at the rate of 2 L/min throughout the surgery. Supplementation with Midazolam, Fentanyl and general anaesthesia was done as and when required. Inj. Mannitol (20%) 0.5 mg /kg BW and Inj. Frusemide 200 mg IV were given before release of vascular clamp. Anastomosis time and duration of surgery were noted.

Heart rate, ECG, pulse oxymetry, temperature and CVP were measured continuously whereas NIBP was recorded every 10 minutes throughout the surgery. IV fluids (NS and Albumin 20%) were infused to keep CVP between 10-15 mm of Hg. Packed cells and fresh frozen plasma were given according to blood loss. BP was maintained within 30 % of baseline values by vasoactive drugs if required. Urine output was measured after ureteric implant in bladder.

At the end of surgery, all patients were transferred to isolation room with vital monitoring. Postoperative analgesia was provided by Inj. Buprenorphine (2 µg/ kg BW) diluted in 10 ml of normal saline when Visual analogue score (VAS) was > 4. Epidural catheter was removed on 3rd postoperative day.

Parameters	Mean ± SD
AGE (Years)	39.2 ± 11.77
SEX [M:F]	312:156
WT (Kg)	53.33 ± 7.89
Duration of surgery (Min)	278.56 ± 23.79

Table 1 Demographic Data

OBSERVATIONS AND RESULTS

In our study of 468 patients, most of the patients were around 40 years, predominantly males, in the age range of 22 - 55 years. Average weight was approximately 53 kg (range: 43 to 66 kg).

Preoperative Medical Condition	Patients (n=468)
Hypertension (requirement of > 2 anti-hypertensive drugs)	312 (56.66%)
ECG changes of Ischemic heart disease	87 (18.58%)
Cardiomegaly on X-Ray Chest	124 (26.49%)
Diabetes Mellitus	42 (08.97%)

Table 2 Preoperative Medical Status

Most of the patients had hypertension due to chronic renal failure. As many as 312 patients were receiving more than two antihypertensive drugs, while 87 patients had ischemic changes on ECG, 124 patients had cardiomegaly due to mainly left ventricular hypertrophy. Chronic renal failure due to diabetes mellitus was present in 42 patients.

Parameters	Mean ± SD
Onset of block (sec)	154 ± 23
Lignocaine-Adrenaline (mg)	264 ± 70.6
Bupivacaine (mg)	64 ± 15.05
Midazolam (mg)	6.5 ± 2.4
Fentanyl (µg)	54.9 ± 23.65

Table 3 Onset of Block and Total Drugs Used

The time of onset of spinal block was 154 ± 23 sec. with maximum sensory level at T 6 segment.

The total amount of Lignocaine-Adrenaline and Bupivacaine required during surgery was 264 ± 70.6 mgs and 64 ± 15.05 mgs respectively. Intraoperatively, patients needed a mean dose of 6.5 ± 2.4 mgs Midazolam and 54.9 ± 23.65 µg Fentanyl for sedation and analgesia. General anesthesia was supplemented in 46 (9.82 %) patients due to inadequate surgical conditions.

As shown in the graph, pulse and blood pressure remained within acceptable range throughout surgery in majority of the patients except just after release of vascular clamp. After clamp release, there was transient tachycardia and significant hypotension in spite of maintaining CVP at supra-normal level, i.e. 16.86 ± 5.98 mm of Hg (mean ± SD), which responded to crystalloids, colloids and blood components.

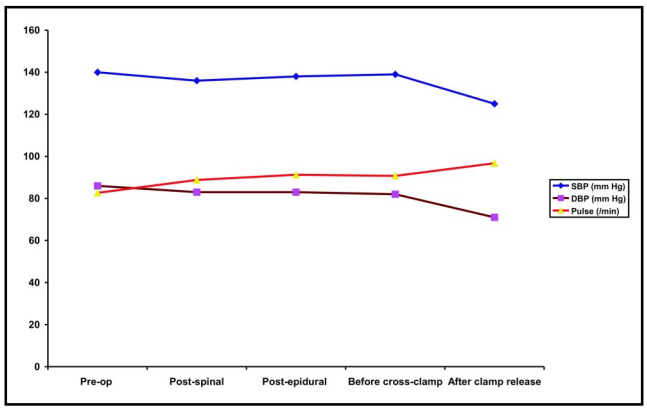

Figure 1 Hemodynamic Changes

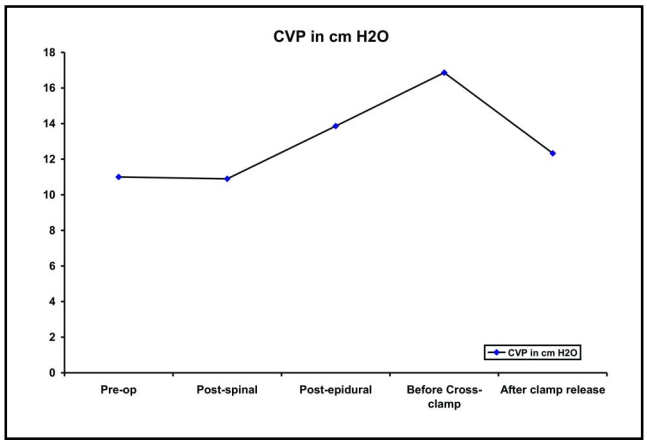

Figure 2 CVP Changes

Complications	Number of patients (n=468)
Nausea	24 (5.12 %)
Vomiting	5 (1.06 %)
Hypotension	78 (16.66 %)
Bradycardia	20 (4.27 %)
Arrhythmias	11 (2.35 %)
Hypertension	21 (4.48 %)

Table 4 Complications

Nausea and vomiting were observed in 29 patients who were treated with anti-emetics; 16.66 % and 4.27 % patients developed hypotension and bradycardia after spinal block and were treated with IV fluids, vasopressors and Atropine. Twenty one patients developed hypertension which required

Inj. Nitroglycerine, 0.5-5µg/ min, for reasonable control. Eleven patients had arrhythmias after clamp release which responded to Inj. Lignocaine, 2 mg/kg BW, IV.

Postoperative Complications	Incidence
Neurological complications	0
Post-dural Puncture headache (PDPH)	0

Table 5 Postoperative Data

We did not find any postoperative neurological complications or headache in any of our patients. For postoperative pain relief, total dose of Buprenorphine required was 354 ± 109 µg during 48 hours. All patients remained awake, pain-free and comfortable in post operative period.

DISCUSSION

Appropriate anaesthesia for renal transplantation requires maintenance of vital functions with minimal toxicity to the patient and graft besides optimal pain relief. Regional anaesthesia is an attractive choice for this lower abdominal extra peritoneal procedure but has remained controversial due to following reasons.

- Unpredictable fall of blood pressure following regional anaesthesia in patients who are hypertensive.
- Difficulty in handling major blood loss or sudden volume withdrawal to transplanted kidney after clamp release.
- Psychological state of recipient may not be ideal for prolonged procedure when he/she is conscious.
- Possibility of hematoma formation in epidural space with coagulation defects leading to neurological sequele.

Both spinal and epidural anaesthesia (EA) have been used for renal transplantation but each has its own drawbacks and limitations[3,4,5]. SA has a drawback of sudden hypotension and limited duration of block whereas EA is associated with delayed onset of action, inadequate muscle relaxation and patchy effect. To overcome the drawbacks of both SA and EA, we selected CSEA which is a recent innovation in regional anaesthesia. This technique initially provides an intense blockade of rapid onset and flexibility of extending the block for entire duration of surgery through epidural catheter. Epidural catheter also helps in providing post-operative pain relief.

Renal allograft recipients are in hyperdynamic circulatory state and have associated acid-base changes which may alter pharmacokinetic of local anesthetics. In our study, the time of onset for sensory block at T 6 level was 154 ± 23 seconds which is shorter than normal patients as observed by Shrivastava et al, Pitkanen et al and Orko et al investigated action of subarachnoid block with 0.75 % plain Bupivacaine in uremic patients[6,7]. They found faster onset of sensory analgesia due to combined effects of acidosis, causing greater degree of ionization and reduced lumbar intrathecal space secondary to distension of epidural veins by the hyperdynamic circulation. Duration of both sensory and motor blockade was shortened by 20 % due to faster wash-out of local anesthetics from their site of action by raised cardiac output. Bromage also observed that duration is actually 38 % shorter than that of normal patients because of hyperdynamic circulation[8].

Maintenance of cardiovascular stability is an important consideration when utilizing CSEA for renal transplantation. Sympathetic blockade can result in significant fall in blood pressure and bradycardia due to depressed barorecepter responses. However in our study, hypotension was observed in 16.6 % patients and bradycardia was present in 4.27 % patients after intrathecal Bupivacaine, which is comparable to non-hypertensive patients receiving spinal anesthesia[9].Only transient significant hypotension was observed immediately after clamp release due to sudden loss of blood volume in transplanted kidney which did not have any adverse effect on immediate graft function. Following top-up doses of Bupivacaine, there were no significant hemodynamic changes. This may be due to meticulous perioperative fluid management keeping the CVP to upper limit of normal. Klassen et al have shown that EA is associated with more stable intra operative hemodynamics with fewer episodes of myocardial ischaemia as compared to neurolept anaesthesia in patients with known cardiovascular diseases[10]. Murakami et al also studied the cardiovascular stability during renal transplantation in 23 paediatric patients and revealed that EA maintained better cardiovascular stability during surgical stress[11]. Blood loss and fluid requirements were found to be lower with EA Solonyko I. et al also reported less cardio depressive effect, stable intra operative hemodynamics and absence of serious postoperative complications after EA in his limited series[12].

Regional techniques may be unsatisfactory for prolonged procedures due to poor patient acceptance, however it had been most gratifying in our study. Many patients were less enthusiastic about the prospect of regional anaesthesia preoperatively but later on they remarked that the experience had been a positive one and subsequently gave positive reinforcement to prospective transplant recipients. Faster onset and good surgical conditions associated with CSEA were appreciated by surgeons and only 9.82 % of patients required general anaesthesia due to inadequate muscle relaxation. In the post operative period, patients remained awake, comfortable and pain-free.

The bleeding tendency of uremia could theoretically be a problem with regional anaesthesia due to risk of hematoma formation. We did not observe any epidural hematoma formation in our patients since all of them were on regular maintenance dialysis preoperatively which reverses primary platelet dysfunction of uremia[13, 14]. However, this possibility should be kept in mind and patients should be closely monitored for early signs of cord compression such as severe back pain, motor or sensory deficits. An opioid alone rather than combination of local anesthesia with opioids allows early detection of neurological sequele. No incidence of post-dural puncture headache or other neurological complication was observed in our study.

Epidural analgesia with narcotics has been shown to be superior to parenteral analgesia for postoperative pain relief by blocking afferent nociceptive stimuli with lesser side effects[15.] During post operative period, majority of patients had good to excellent postoperative analgesia with Buprenorphine given through epidural route resulting in early ambulation and patient satisfaction. Dauri M et al also noted that epidural Ropivacaine resulted in more effective postoperative analgesia compared to IV Tramadol in renal transplantation [16].

CONCLUSION

CSEA proved to be a useful regional anaesthetic technique combining the reliability of spinal block and versatility of epidural block for renal transplantation. The advantages are immediate onset of anesthesia, good muscle relaxation, less failure rate with ability to prolong the duration of anaesthesia with low incidence of complications.

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