ISSN- O: 2458 - 868X, ISSN–P: 2458 – 8687
National Library of Medicine - ID: 101731606

International Journal of Medical Science and Innovative Research (IJMSIR)
IJMSIR : A Medical Publication Hub
Available Online at: www.ijmsir.com
Volume – 6, Issue – 6, November – 2021 , Page No. : 69 - 77

Sevoflurane sparing effect of dexmedetomidine in patients undergoing robotic renal transplant: Original research

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Citation this Article: Dr. Nautam Pranami, Dr. Noykilla Lepcha, Dr. Vipulkumar J. Panchal, Dr. Beena Parikh, "Sevoflurane sparing effect of dexmedetomidine in patients undergoing robotic renal transplant: Original research", IJMSIR- November - 2021, Vol – 6, Issue - 6, P. No. 69 – 77.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Background: Robotic renal transplant surgery is one of the advanced surgery with many beneficial advantages to the patient that facilitates minimal access, less pain, early mobilisation, and better cosmetic results. But steep trendelenberg position for longer duration and pneumoperitoneum as demanded by surgery affects several haemostatic mechanisms which makes an anaesthetic challenging to stabilise the haemodynamic intraoperatively.

Methods: Patients undergoing robotic renal transplant surgery under general anaesthesia were divided into two groups of 25patients each to receive injection of dexmedetomidine with sevoflurane infusion(group D+S) and injection of normal saline with sevoflurane infusion(group S) to see their efficacy in regards to presser responses to intubation , intra operative hemodynamic stability, requirement of injection nitroglycerin and post operative sedation by Ramsey sedation score.

Results: There was 11 % decrease in heart rate in group D+S and 7% increase in heart rate after intubation. MAP was stastitically significantly low in group D+S as compared to group S after infusion , after intubation and after pneumoperitoneum. NTG requirement 30% decrease in group D+S than group S. 5 Point extubation quality score is statistically significantly low in group D+S(=1.52±0.49) than group S(= 2.44±0.69).

Conclusion: Combined use of Dexmedetomidine and Sevoflurane provides better haemodynamic stability intraoperatively with minimum use of injection nitroglycerin, good quality of extubation and post-operative sedation.

Keywords: Dexmedetomidine, Pneumoperitoneum, Robotic Renal transplant, Sevoflurane

Introduction

Kidney transplantation is a preferred therapeutic option for patients with end stage renal disease compared with dialysis. The benefit of robotic surgeries are minimal access, less pain, early mobilization, shorter hospital stay, and better cosmetic results which have further increased its applications. To facilitate robotic renal transplant surgeries, the patient should be in steep trendelenberg position and pneumoperitoneum that affects several homeostatic mechanisms leading to alteration in acid base balance, CVS, pulmonary physiology, and stress response. Hence, the effect of dexmedetomidine with sevoflurane and sevoflurane only is compared on hemodynamic in CRF patients undergoing robotic renal transplant.

Dexmedetomidine is a a-2 receptor agonist with properties of analgesia, sympatholysis and titrating sedation without major respiratory depression. Sevoflurane is a volatile, non-inflammable, non-irritant, easy to administer compound with a low solubility profile and blood to gas coefficient. It is used to blunt the hemodynamic overshoot caused during robotic procedures maintaining a steady heart rate and minimal change in blood pressure.

Material and Methods

After local ethics committee approval and written informed consent, patients of ASA physical status 3 of either sex were randomly selected for this study. They were scheduled for elective robotic renal transplant under general anaesthesia and divided into two groups. Patients posted for emergency surgical procedures, patients with cardiovascular or respiratory, pregnant mothers, currently breast-feeding mothers, sleep apnoea ailment patients, psychiatric disorder and paediatric patients were excluded from the study. Preanesthetic check-up was conducted and a detailed history and complete physical examination recorded, routine investigations like complete hemogram, random blood sugar, serum creatinine, chest x- ray (PA view), electrocardiogram and 2D echo (selected patients) were done. On the day of surgery, after shifting the patient to the operating room, patient's baseline values of heart rate, non-invasive blood pressure, pulse oximetry, electrocardiography were recorded. An 18 guage intravenous cannula was inserted and normal saline was started. Before induction of anaesthesia, the group D+S patients were given dexmedetomidine 1mcg|kg loading dose infusion (diluted in 20ml syringe) over 10 minutes while in group S patients received normal saline 20ml over 10 minutes. Heart rate, systolic blood pressure, diastolic blood pressure, mean arterial blood pressure and BIS were noted at regular interval. Balanced general anaesthesia was administered for all the patients. The patients received premedication, intravenous doses of 0.2 mg glycopyrrolate, 2mcg|kg fentanyl, 4mg ondansetron before induction of anaesthesia. Induction was achieved with 5-7 mg|kg intravenous thiopentone, intubation was facilitated with intravenous succinyl choline and muscle relaxation maintained with 0.5mg /kg/hr of atracurium infusion. After induction, double lumen Internal jugular vein catheter inserted and radial artery cannulation was done on opposite hand of fistula. The lungs were ventilated by maintaining tidal volume of 7 to 10 mg|kg, a frequency of 12-16 breaths|min and an Etco2 of 30 to 40 mmHg in 2.5L/min of fresh gas flow with air in a closed circuit. Sevoflurane inhalation was titrated at flow rate of 2.5 L/min according to the hemodynamic requirement. In group D+S inj. Dexmedetomidine maintenance (0.2 – 0.7mcg/kg/min) infusion was given till deflation of pneumoperitoneum and sevoflurane inhalation was set to maintain desired hemodynamic. IN group S inj.Normal saline infusion was given and sevoflurane inhalation was started and maintained to achieve desired hemodynamic. HR, IBP, SPO2, ECG and ETCO2 were recorded. The aim was to maintain HR less than 20% of the baseline and MAP <110mmhg.The measurements were taken throughout the study at the following times: baseline, after loading dose, after intubation, 20 min after the pneumoperitoneum, 60 minutes after creation of pneumoperitoneum, after 5 min after infusion stopped and after extubation. Intraoperative bradycardia was treated with inj. atropine 0.6mg. Intraoperative hypotension was treated with intravenous crystalloids, inj. Mephentermine, and by reducing sevoflurane concentration. Intraoperative hypertension was treated with increasing sevoflurane concentration till BIS value becomes 40 and if not responded then inj. nitroglycerine in incremental dose was started. Sevoflurane inhalation 37 was stopped 10 minutes before the end of the surgery and inj dexmedetomidine stopped after deflation of pneumoperitoneum. On completion of surgery, the neuromuscular blockage was reversed with 0.05mg|kg intravenous neostigmine and 0.008 mg/kg glycopyrrolate. After extubation, volume of sevoflurane uptake was noted from anaesthesia machine (PRIMUS) . Volume of NTG (nitroglycerine) , RSS score, quality of recovery were noted by 5 point extubation score and in post operative period RSS score noted for 4 hours.

Result and Discussion

Fifty patients were randomly selected and compared using injection of dexmedetomidine with sevoflurane infusion (group D+S) and injection of normal saline with sevoflurane infusion (group S) to see their efficacy in regards to pressure responses to intubation, intra operative hemodynamic stability and post-operative sedation by Ramsey sedation score.

Demographic Data: It show no significant difference in age, sex, weight, ASA and duration of surgery (p value > 0.05) in both groups.

Peri Operative Changes In Heart Rate: There was 11 % decrease in heart rate after intubation in group D+S. In group S 7% increase in heart rate was noted after intubation.

Table 1: Heart Rate

Perioperative Changes In HR	Group D+S (N=25)	Group S (N=25)	p-value
Baseline	93.28±17.44	97.28±15.57	0.40
After infusion	84.00±15.34	96.80±15.27	<0.01
After intubation	90.04±11.95	102.08±15.70	<0.01
Afte Pneumoperitoneum	92.76±13.83	102.72±14.66	0.02
20mins after pneumoperitoneum	90.32±15.14	99.56±12.36	0.02
60mins after pneumoperitoneum	88.88±14.55	98.20±11.36	0.02
After infusion stop	93.20±13.37	99.08±12.94	0.12
After extubation	101.80±15.35	105.44±15.19	0.40

Mean Arterial Pressure

Perioperative Changes In Map	Group D+S(N=25)	Group S (N=25)	P - value
baseline	119.52±13.57	114.24±14.61	0.19
After infusion	103.32±7.42	112.40±12.44	0.003
After intubation	107.48±6.69	115.40±14.41	0.016
After pneumoperitoneum	109.60±5.97	115.72±13.34	0.041
20min after pneumoperitoneum	112.24±13.18	115.00±7.83	0.37
60min after pneumoperitoneum	112.24±13.18	115.68±8.40	0.16
After infusion stop	112.32±8.18	116.00±9.70	0.15
After extubation	114.08±11.23	118.96±11.34	0.13

Above table shows MAP is statistically significant low in group D+S as compared to group S after infusion, after intubation and after pneumoperitoneum. .After stopping of infusion and after extubation decrease in MAP was not statically significant (p>0.05)

Nitroglycerine (NTG) requirement:

Consumption of NTG (mg)	Group D+S No. of patients	Group S No. of patients
0-10	1	3
11-20	5	3
21-30	4	8
>31	0	6

Total consumption of NTG (mg) in group D+S =19.1±5.16

Total consumption of NTG (mg) in group S = 26.30±10.54.P value=<0.01 which is statistically significant. NTG requirement 30% decrease in group D+S than group S.

Sevoflurane uptake:

Sevoflurane uptake(ml)	Group D+S No. of patients	Group S No. of patients
<10	9	1
11-15	10	3
15-20	5	10
20	1	11

Sevoflurane Uptake: Total uptake of sevoflurane in group D+S =12.68±4.57 ml Total uptake of sevoflurane in group S = 20.08±5.19 ml p value <0.01 which is statistically significance. Sevoflurane requirement decrease by 33 % in group D + S than group S.

RSS Score (Ramsay sedation score):

Post operative	Group D+S (N=25)	Group S (N=25)	P - value
1hr	2.8±0.69	1.52±0.71	<0.01
2hr	1.36±0.49	1±0	<0.01
3hr	1±0	1±0	-
4hr	1±0	1±0	-

In group D+S =1.52±0.49 In group S = 2.44±0.69, p value =<0.01. 5 Point extubation quality score is statistically significantly low in group D+S than group.

In our study mean heart rate was statistically significantly lower in group D+S as compared to group S after laryngoscopy and intubation. After intubation, in group S there was 7% increase in heart rate and 9% increase in MAP, group D+S there was 4% decrease in HR and 6% decrease in MAP. If we compare our study with study done by dr. chirag et al [41], there was 3.7% rise in HR in their control group whereas 7% increase in HR in our study. In study group they observe 6.5% fall in HR where as in our study 4% decrease in HR.

This difference in observation may be because they included patients of ASA risk 1 and 2, which include non-hypertensive or well controlled hypertensive patients posted for laparoscopic cholecystectomy. Duration of surgery in their group was around 1 hour. In our study, surgery lasted for more than 4 hours and patients were cases of CRF on multiple anti-hypertensive drugs i.e, they belong to ASA 3. In our study no patient required treatment for bradycardia. This may be because we have infused dexmedetomidine over 10 minutes and maintenance dose was also titrated on a case by case basis. Varshali et al [8] observed bradycardia in 2 patients which may be because their study was for open surgery. Stability in MAP was achieved by slowly infusing dexmedetomidine over 10 minutes at an adequate dosage for the patients. Simultaneously, anesthetic depth was also maintained in both the groups, a BIS value of about 40-45 by controlling sevoflurane vaporizer setting. Intraoperative co-administration of dexmedetomidine with other anesthetics could potentiate any haemodynamic instability by over sedation or over dosing. Therefore , use of an anesthetic depth monitor like BIS is essential when employing a dexmedetomidine adjuvant for general anesthesia In our study, if BIS was between 40-45, still MAP >110 mm Hg than NTG was started. In group D+S(19.1±5.16), 10 patients required NTG where as in group S(26.30±10.54), 20 patients required NTG. Dose requirement of NTG was higher in group S, which is statistically significant. The quality of extubation was better in group D+S (mean extubation quality score 1.52±0.49) than group S (mean extubation quality score 2.44±0.69) which was statistically significant. In accordance to the Ramsay sedation score, post-operative sedation was significantly high in group D+S when compared to that group S, which is statistically significance. Lingling ding,Hong zhang et al[46] published the improvised effects of dexmedetomidine on anaesthesia and recovery and post-operative cognitive function of patients posted for robot assisted laparoscopic radical cystectomies, which correlates with our study.

Conclusion

In our study heart rate and mean arterial pressure were being monitored continuously and has been documented that both of the parameters were well controlled in group D +S as compared to the group S, which has been statistically confirmed but patients were haemodynamically stable throughout the study in both the groups. The usage of adjunctive antihypertensive therapy (NTG) intra operatively was statistically significantly more in group S than that of group D+S. Due to dexmedetomidine infusion throughout surgery sevoflurane requirement decreased in group D+S as compared to group S. Quality of extubation and post-operative sedation were significantly good in group D +S as compared to that of group S

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