The Egyptian Journal of Hospital Medicine (July 2018) Vol. 72 (10), Page 5461-5465

A Comparative Study between Magnesium Sulphate and Nitroglycerin with Propranolol in Controlled Hypotensive Anaesthesia during Middle Ear Surgeries

Hoda Omar Mahmoud, Manal Kamal Shams, Adel Alaa El-din Habib,
Amr Abdel Monem Al Sayed Ali*
Department of Anesthesia, Intensive care and Pain Management, Faculty of Medicine, Ain Shams University
***Corresponding author:** Amr Abdel Monem Al Sayed Ali, **Mobile:** 01060577012, **Email:** amrmenem1990@gmail.com

ABSTRACT

Background: controlled hypotension is performed in order to reduce blood loss and the need for transfusion during the surgery and to improve visibility of the surgical site by decreasing the arterial pressure until hypotension is reached. **Aim of the Work:** to compare magnesium sulphate and nitroglycerin with propranolol during middle ear surgery in terms of regarding their efficiency in inducing deliberate hypotension and providing a better surgical field exposure during middle ear surgery. It also compared the influence of their use of postoperative pain and recovery time. **Patients and Methods:** forty adult patients undergoing middle ear surgery were included. Patients were randomly divided into two equal groups. Patients were assigned to receive magnesium sulphate (M group) and nitroglycerin with propranolol (N group) from the period of Jan 2018 to August 2018. ASA physical status I, age group ranged from 18 to 60. **Results:** the current study shows the ability of magnesium sulphate and nitroglycerin with propranolol to induce deliberate hypotension in patients undergoing middle ear surgery. Mean arterial pressure was successfully reduced to the target values in both groups. All drugs were equally successful to produce satisfactory surgical field. **Conclusion:** this study included forty adult patients age ranged 18 to 60 undergoing middle ear surgery was included. Patients were randomly divided into two equal groups. Patients were received magnesium sulphate (M group), or nitroglycerin and propranolol (N group).

Keywords: Mean arterial pressure, post anesthetic care unit.

INTRODUCTION

Several pharmacologic agentshave had been used to produce deliberate hypotension. Direct vasodilators as nitroprusside and nitroglycerine, alpha-2 adrenergic agonistsasclonidine and dexmedetomidine, beta adrenergic antagonists aspropranolol and esmolol, alphaand betaadrenergic antagonistsaslabetalol, inhalational anesthetics as isoflurane and sevoflurane, μ-receptors agonist as remifentanil, and N-methyl d-aspartate antagonist asmagnesium were all used to induce hypotension during middleear surgery [(1)]. Magnesium is the fourth most common salt in the human body after phosphorus, calcium and potassium. Magnesium sulphate was previously used to induce deliberate hypotension and it producesits hypotensive effect by limiting the outflow of calcium from the sarcoplasmic reticulum and producesa vasodilation effect by increasing the synthesisof prostacyclin and inhibiting angiotensin converting enzyme activity. Hypotension induced by magnesium during surgery is also explained by its powerful analgesic effect. The analgesic action of magnesium is explained by its antagonistic effect at N-methyl d-aspartate receptors [(2)].

AIM OF THE WORK

The aim of our study is to compare magnesium sulphate and nitroglycerin with propranolol during middle ear surgery in terms of regarding their efficiency in inducingdeliberate hypotension and providinga better surgical field exposureduring middleear surgery. It also compared the influence of their use of postoperative pain and recovery time.

PATIENTS AND METHODS

Forty adult patients undergoing middle ear surgery were included. Patients were randomly divided into two equal groups. Patients were assigned to receive magnesium sulphate (M group) and nitroglycerin with propranolol (N group) from the period of Jan 2018 to August 2018. ASA physical status I, age group ranged from 18to 60. **The study was approved by the Ethics Board of Ain Shams University and an informed written consent was taken from each participant in the study. Exclusion criteria:** Hypertension, allergic reactions to study drugs, renal, hepatic, or cardiovascular diseases, neuromuscular disease, atrio-ventricular conductance disturbance, opioid or analgesic abuse, and chronic treatment with opioids, or non- steroidal anti-inflammatory drugs. **Methods:** In the operating room, the ECG electrodes were placed, an IV cannula was introduced and infusion of acetated Ringer's solution was started approximately10 min before

Received:21/6/2018
Accepted:30/6/2018

induction of anesthesia. HR, non-invasive arterial pressure, oxygen saturation, inspiratory oxygen, end-tidal carbon dioxide, and respiratory parameters were monitored approximately 5 min before induction of anesthesia for baseline recording. After pre-oxygenation via face mask, anesthesia was induced with propofol 3 4 mg/ kg IV In all groups and then study drugs were given. Patients in M group were received an IV bolus of magnesium sulphate 50 mg/kg in a total of 100 ml saline over 10 min followed by infusion of 15 mg/kg/h until the end of operation. Patients in N group were received nitroglycerin IV infusion 0.5-10 mcg/kg/min (dosage based on hemodynamic parameters) with propranolol 1 mg IV slowly. In all groups after loss of eyelid reflex, patients were ventilated with 1 MAC isoflurane and tracrium (atracurium besylate) 0.5 mg/kg IV was given to facilitate tracheal intubation. Muscle relaxation was reversed with atropine 0.02 mg/kg and neostigmine 0.04 mg/kg I.V. Anesthesia was maintained with 1 MAC isoflurane and lungs were ventilated with oxygen and medical air at a ratio of 1:1. Mean arterial blood pressure (MAP) and heart rate (HR) were recorded before induction of anaesthesia (baseline), 1 min after induction of anaesthesia, 1 min before intubation, 1 min after intubation then every 15 min intra-operatively, 1 min before extubation and 5 min after extubation. If hypertension or tachycardia more than 20% of the preoperative value occurred, fentanyl 1 µg/kg was given IV If hypotension or bradycardia more than 20% of the preoperative value occurred, 5 mg ephedrine for hypotension or 0.5 mg atropine for bradycardia was given IV. Patients in all groups were received antiemetic (metoclopramide 10 mg IV) to prevent nausea and vomiting. Mean arterial blood pressure (MAP) was maintained within the range of 50 to 65 mmHg to reduce bleeding in the surgical field. The surgeons who were not aware of the selected hypotensive agent were asked to assess the quality of the surgical field according to the quality scale proposed by from me and colleagues.

Statistical methods: Data were coded and entered using the statistical package SPSS version 21. Data was summarized using mean and standard deviation for quantitative variables and frequencies (number of cases) and relative frequencies (percentages) for categorical variables. Comparisons between quantitative variables were done using analysis of variance (ANOVA) with multiple comparisons post hoc test. For comparing categorical data, Chi square (X2) test was performed. Exact test was used instead when the expected frequency is less than 5. P-values less than 0.05 were considered as statistically significant.

RESULTS

Table (1): Mean arterial blood pressure measurement before, during, after extubation.

		Magnesium sulphate group	Nitroglycerin with propranolol	Overall P value
MAP at base line 5 minutes before induction	Mean	80.20	75.90	0.0462
	Standard Deviation	5.09	7.82	
MAP 1 minute before Intubation	Mean	84.80	77.60	0.006
	Standard Deviation	3.55	10.47	
MAP 1 minute after Intubation	Mean	78.80	77.50	0.5021
	Standard Deviation	5.37	6.69	
MAP 15 minute after Intubation	Mean	75.80	68.70	0.0017
	Standard Deviation	3.58	8.67	
MAP 30 minute after Intubation	Mean	74.90	67.90	0.0015
	Standard Deviation	5.09	7.58	
MAP 45 minute after Intubation	Mean	72.20	66.50	0.017
	Standard Deviation	5.18	8.81	
MAP 60 minute after Intubation	Mean	70.70	65.30	0.0789
	Standard Deviation	4.92	9.71	
MAP 75 minute after Intubation	Mean	69.90	64.44	0.0224
	Standard Deviation	5.28	9.15	
MAP 90 minute after Intubation	Mean	68.86	66.00	0.173
	Standard Deviation	4.74	8.22	
MAP 1 minute before Extubation	Mean	80.80	73.00	0.0031
	Standard Deviation	5.90	9.33	
PACU 15 minutes (MAP)	Mean	76.10	72.70	0.0604
	Standard Deviation	6.44	4.50	
PACU 30 minutes (MAP)	Mean	74.70	74.10	0.0216
	Standard Deviation	4.69	4.25	

Table (2): Heart rate (HR) measurement before, during, after extubation.

		Magnesium sulphate group	Nitroglycerin with propranolol	Overall P value
HR at base line 5 minutes	Mean	86.00	98.20	0.0026
before induction	Standard Deviation	7.06	15.35	
HR 1 minute before	Mean	79.80	89.20	0.0077
Intubation	Standard Deviation	9.62	13.07	
HR 1 minute after	Mean	83.20	96.20	0.0013
Intubation	Standard Deviation	9.91	13.55	
HR 15 minute after	Mean	80.50	88.40	0.0482
intubation	Standard Deviation	9.29	12.07	
HR 30 minute after	Mean	75.20	80.90	0.0481
intubation	Standard Deviation	8.51	8.74	
HR 45 minute after	Mean	76.30	78.00	0.483
intubation	Standard Deviation	7.29	8.04	
HR 60 minute after	Mean	76.10	75.10	0.689
intubation	Standard Deviation	5.55	9.49	
HR 75 minute after	Mean	76.67	73.70	0.504
intubation	Standard Deviation	4.87	7.83	
HR 90 minute after	Mean	75.50	73.50	0.907
intubation	Standard Deviation	.71	18.87	
1 minute before	Mean	82.00	76.10	0.0758
extubation	Standard Deviation	7.89	12.75	
PACU 15 minutes (HR)	Mean	76.60	78.10	0.0835
	Standard Deviation	8.66	7.26	
PACU 30 minutes (HR)	Mean	75.30	79.30	0.083
	Standard Deviation	7.73	6.41	

Table (3): The quality of surgical field during operation and visual analog scale.

		Magnesium sulphate group	Nitr~!oglycerin with propranolol	Overall P value
The quality of surgical field.	Mean	2.00	2.00	Constant
	Standard Deviation	.00	.00	
Visual analog scale	Mean	41.00	41.00	1
	Standard Deviation	3.16	3.16	

DISCUSSION

This study included forty adult patients age ranged 18 to 60 undergoing middle ear surgery was included. Patients were randomly divided into two equal groups. Patients were received magnesium sulphate (M group) or nitroglycerin and propranolol (N group) from the period of Jan 2018 to August 2018. In a study by ***Ryu et al.*** [3] in which controlled hypotension magnesium sulphate and remifentanil were compared during middle ear surgery. In this study, Controlled hypotension was well maintained in both groups. Mean arterial blood pressure and heart rate were higher in remifentanil group than in magnesium sulphate group after operation. Surgical conditions were not different between the two groups. Postoperative pain scores were significantly lower in magnesium sulphate group than in remifentanil ($P<0.05$). Magnesium sulphate has more advantages during the emergence and postoperative periods, and that its usage was associated with more stable perioperative haemodynamics (smaller increases in MAP and HR) and better recovery profiles (less postoperative pain) than remifentanil. In a study by ***Adnan and Ays*** [4] in which controlled hypotension magnesium sulphate and dexamedetomidine were compared during functional endoscopic surgery to investigate the effects of magnesium sulfate and dexmedetomidine used for controlled hypotension on the visibility of the surgical site. In this study magnesium sulphate was administrated as 40 mg/kg I.V. bolus and 15 mg/kg/hour. IV infusion and provided the target mean arterial blood pressure and fair surgical field but surgeon satisfaction was better in dexmedetomidine group. As for the present study magnesium sulphate was administrated as 50 mg/kg I.V. bolus and 15 mg/kg/hour infusion and had the ability to maintain

deliberate hypotension throughout the operation but nitroglycerin with propranolol gave better values at shorter time. In another study, ***Ossama et al.*** [5] this study was designed to compare magnesium sulphate with dexmedetomidine, regarding their efficiency in inducing deliberate hypotension and providing a better surgical field exposure during middle ear surgery. It also compared the influence of their use on postoperative pain and recovery time. Both study drugs succeeded to reach the target mean arterial blood pressure. The quality of the surgical field was not different between the two groups. Postoperative pain was not different between the two groups and only eight patients in the magnesium sulphate group and seven patients in the dexmedetomidine group required analgesics but magnesium sulphate was associated with shorter recovery time and earlier discharge from the PACU. As for the current study magnesium sulphate had the ability to maintain deliberate hypotension throughout the operation but was needed more time to reach target than in nitroglycerin with propranolol group [6]**.** In which controlled hypotension magnesium sulphate and remifentanil were compared, mean arterial blood pressure values were found same in both groups. Mean arterial blood pressure values were found more stable in the period of intubation and extubation in remifentanil group. As for the present study, we had found that mean arterial pressure values were nearly the same using magnesium sulphate and nitroglycerin with propranolol. In the same study extra drug was required in magnesium sulphate group. With regard to the present study, no extra drug was required in magnesium sulphate group. In another study ***Mishra et al.*** [7] in which a comparison between nitroprusside and nitroglycerin for hypotensive anaesthesia in ear, nose, and throat surgeries were done. This study shows that the time to achieve desired level of hypotension using nitroglycerin longer than that with sodium nitroprusside. Mean time to achieve hypotension was 18.25 ± 2.45 min in nitroprusside group, whereas, in nitroglycerin group, it was 30.00 ± 5.13 min. The time to achieve hypotension was significantly lower in nitroprusside group as compared to nitroglycerin group ($P < 0.001$). In this study was reported that there were cases with reflex tachycardia. In the current study, Mean time to achieve hypotension was 45 minutes in magnesium sulphate, whereas in nitroglycerin group it was 15 minutes this might return to the difference in inhalational agent used as we used isoflurane as inhalational agent but in this study nitrous oxide with fresh oxygen was used. No cases with reflex tachycardia were reported as we use from the beginning propranolol. In another study ***Maktabi et al.*** [8] in this study, nitropusside appeared to be better than nitroglycerin in hypotension. In another study ***Akkaya et al.*** [9] in which mean arterial pressure (MAP) analysis revealed that the blood pressure was lower for a short period of time in dexmedetomidine group at the 35th and 65th min. Dexmedetomidine group showed a significant decrease in intraoperative surgical field evaluation scale score and heart rate. The average operation time was 50 min, and magnesium sulphate group had a higher number of prolonged surgeries. No significant difference was found in the other parameters. As for our study target mean arterial blood pressure was reached after 45 minutes from beginning of the operation in magnesium sulphate group and heart rate within normal throughout the operation. In a study ***Elsharnouby and Elsharnouby*** [2]; there was 2 groups one group receive magnesium sulphate and the other was control group this study found that magnesium sulphate led to reduction in arterial pressure, heart rate, blood loss and duration of surgery as for our study magnesium sulphate produced a good hypotensive anesthesia with fair surgical field.

CONCLUSION

We concluded that magnesium sulphate and nitroglycerin with propranolol successfully induced hypotension during middle ear surgery but the difference was between times at which target arterial blood pressure was reached, the two drug groups also gave a fair surgical field.

CONFLICTS OF INTEREST

There are no conflicts of interest.

REFERENCES

1. Degoute C (2007): Controlled hypotension: a guide to drug choice. Drugs, 67:1053-76.

2. **Elsharnouby NM and Elsharnouby MM (2006):** Magnesium sulphate as technique of hypotensive anaesthesia, Br J Anaesth., 9: 727-31.

3. **Ryu JH, Sohn IS, Do SH (2009):** Controlled hypotension for middle ear surgery: a comparison between remifentanil and magnesium sulphate. Br J Anaesth., 103: 490-5.

4. **Adnan B and Ays U (2014):** Is, in Gunesa, Ibrahim Ketencib et al, Brazilian Journal of Anesthesiology (English Edition), 65(1): 61 67.

5. **Ossama HA, Ahmed MES, Ahmed MO *et al.* (2011):** A comparative study between magnesium sulphate and dexmedetomidine for deliberate hypotension during middle ear surgery. Egyptian Journal of Anaesthesia, 27(4): 227 232.

6. **Doger E and OzgunInt G (2012):** Controlled Hypotension: a comparison between magnesium sulphate and Remifentanil in Middle Ear Surgery. Adv. Otol., 8 (1): 87-93.

7. **Mishra A, Singh RB, Choubey S *et al.* (2015):** a comparison between nitroprusside and nitroglycerin for hypotensive anesthesia in ear, nose and throat surgeries: a double-blind randomized study. Medical Journal of Dr. D.Y. Patil University, 8(2): 15-23.

8. **Maktabi M, Sokoll M, Adolphson A, Speed T *et al.* (1986):** Comparison of nitroprusside, nitroglycerin and deep isoflurane anesthesia for induced hypotension. Neurosurgery, 19:350-5.

9. **Akkaya A, Tekelioglu UY, Demirhan A *et al.* (2014):** Comparison of the effects of magnesium sulphate and dexmedetomidine on surgical vision quality in endoscopic sinus surgery: randomized clinical study. Brazilian Journal of Anesthesiology (English Edition), 64(6): 406-412.