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# The Comparison of the Effects of Dexmedetomidine and Magnesium Sulphate in Endoscopic Transnasal Transsphenoidal Resection of Pituitary Adenoma

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**Abstract:** ***Transsphenoidal resection of the pituitary tumours involves wide fluctuations inhaemodynamic parameters such as hypertension and tachycardia due to local adrenaline infiltration, during nasal speculum insertion and during sphenoid resection. It is challenging for anaesthetist to provide bloodless field, heamodynamiac stability, surgical approach. In this study we compared the effects of dexmedetomidine and magnesium sulphate on the adequacy of hypotensive anaesthesia to produce bloodless field and decreasing the bloodloss in adult patients undergoing transsphenoidal resection of pituitary tumours. Using Boezaart surgical field grading and surgeons satisfaction score surgical field was graded. From our results we conclude that dexmedetomidine has advantage of causingcontrolled hypotension and reduction in heart rate with minimal blood loss compared to magnesium sulphate.***

**Keywords:** dexmedetomidine, magnesium sulphate, bloodless field, hemodynamic stability, controlled hypotension

## 1. Introduction

Pituitary gland tumours of brain are present in 10% of cases of brain tumors[1]. Of these tumours 20% of tumors are resected by transsphenoidal approach. During transsphenoidal resection of these pituitary tumours, adrenaline is injected submucosally in the nose so there are wide fluctuations in haemodynamic parameters such as hypertension and tachycardia. The challenges for the anaesthetist during transsphenoidal resection includesurgical approach, the effects of hormone secretion by pituitary tumours, maintenance of clear bloodless field by adequate hypotensive anaesthesia so that surgeon can be able to resect the tumour through transsphenoidal approach[2].For decreasing blood pressure and maintaining hypotensive anaesthesia, many hypotensive agents are used intraoperatively. Dexmedetomidine is highly selective alpha 2 agonist[3]. It has sedative, analgesic,anxiolytic and sympatholytic properties that blunt many of the cardiovascularresponses during intraoperative period.Its onset of action is rapid followingintravenous administration. Magnesium is an N-methyl-d-aspartate receptor antagonist that reduces the needfor analgesic and sedative drugs, and it is a good agent for a controlledhypotension[4].Magnesium inhibits the release of norepinephrine by blocking N-type Ca ++channels at nerve endings and thus decreases the blood pressure[5]. Its onset of action is immediate after iv administration.Controlled hypotension is performed in order to improve visibility of thesurgical site by reducing blood pressure, to reduce blood loss and the needfor transfusion during the transsphenoidal resection.

**Aim:**
To study the effect of dexmedetomidine and magnesium sulphate in causing

- Hypotension in providing good bloodless field to surgeons
- Hemodynamic stability
- Controlled hypotension

## 2. Materials and Methodology

A study of 40 patients of either sex, ASA-I/II/III in any age groupwas conducted in patients undergoing surgery in general anesthesia in civilhospital Ahmedabad during a period from October 2017 to 2019.

**Study Design**

- This is prospective, randomised, observational, double blind study.
- 40 patients were divided into two equal groups.Patients were randomly divided into two groups**.**
- Group D-inj**.** dexmedetomidine was given as a loading dose 1mcg/kg over 10 minbefore induction followed by an infusion at 0.5 mcg/kg/hr during the surgery.

- Group M-inj**.** magnesium sulphate was given as loading dose of 50mg/kg over 10min followed by an infusion at 15mg/kg/hr during the surgery.

**Inclusion Criteria:**

- Patients over the age of 18-65 years
- ASA 1, 2,3
- Patients who are posted for transnasal endoscopic pituitary adenoma resection surgery
- Either gender

**Exclusion Criteria**

- Patient refusal
- Allergy to study medications

## 3. Procedure

After getting informed written consent, Patients were taken on OT table and allthe minimum mandatory monitors that are noninvasive blood pressure (NIBP), heart rate (HR),pulse oximetry, end tidal CO2, were applied.Patients were randomly divided into two groups **(**Group D & Group M). Then patients were premedicated with inj. glycopyrrolate 4µg/kg, fentanyl 2µg/kg and ondansetron 0.15mg/kg IV 20 minutes prior toinduction. Patients were induced with Inj. Thiopentone Sodium 6mg/kg and Inj. Succinyl Choline 2mg/kg IV to facilitate tracheal intubation withproper endotracheal tube size. Patients were maintained under controlled ventilation with O2,sevoflurane and NMB. After completion of surgical procedure, the patients were extubated after reversal of NMB by neostigmine 0.05mg/kg and glycopyrrolate 8µg/kg IV. Patients were transferred to post anaesthesia care unit (PACU).Throughout the procedure heart rate (HR), blood pressure, SPO2, ETCO2 were observed.

**Boezaart score**

0) No bleeding.
1) Slight bleeding, blood suctioning is not required.
2) Mild bleeding, occasional suctioning without interference of surgical field.
3) Moderate bleeding, suctioning is usually used .bleeding threatenssurgical field but improves after suctioning.
4) Heavy bleeding, suctioning is frequently used .bleeding threatenssurgical field directly after suction is removed.
5) Severe bleeding .bleeding appears faster than suctioning and isuncontrollable.

**Surgeon's satisfaction score**

1 -bad
2-moderate
3-good
4-excellent

## 4. Results

The observations and results of this study have been summarized in tabulated form. The patientshave been divided into two groups with 20 patients in each group (n=20).

**Table 1:** Comparison of HEART RATE between two groups

| Heart Rate | Group D | | Group M | | p-value |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| Baseline | 92.50 | 5.59 | 94.80 | 2.49 | |
| Before Induction | 79.40 | 7.32 | 88.05 | 3.97 | 0.001(S) |
| At 15Minutes | 68.30 | 4.96 | 81.85 | 5.74 | 0.001(S) |
| At 30 Minutes | 63.70 | 4.09 | 79.70 | 5.29 | 0.001(S) |
| At 1 Hr | 62.80 | 3.13 | 74.75 | 4.91 | 0.001(S) |
| At 2 Hr | 61.35 | 2.88 | 71.40 | 3.64 | 0.001(S) |
| Before Extubation | 60.80 | 2.46 | 73.10 | 4.38 | 0.001(S) |
| 5 Minutes after Extubation | 61.00 | 2.61 | 72.30 | 4.13 | 0.001(S) |
| PACU | 60.30 | 2.31 | 83.30 | 6.42 | 0.001(S) |

From the above table it is evident thatPulse rate has been significantly lower in dexmedetomidine group throughout the intraoperative period in comparison to M group (P value<0.05)

**Table 2:** Comparison of Mean Blood Pressure (MAP) between two groups

| Mean Blood Pressure | Group D | | Group M | | p-value |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| Baseline | 103.58 | 3.59 | 101.13 | 2.86 | |
| Before Induction | 88.35 | 2.15 | 91.56 | 5.47 | 0.019(S) |
| At15 Minutes | 75.51 | 1.57 | 87.98 | 5.84 | 0.001(S) |
| At30 Minutes | 71.55 | 2.21 | 86.55 | 7.51 | 0.001(S) |
| At 1 Hr | 69.91 | 2.11 | 87.68 | 7.40 | 0.001(S) |
| At 2 Hr | 67.73 | 1.63 | 86.50 | 8.41 | 0.001(S) |
| Before Extubation | 66.96 | 1.74 | 85.86 | 7.62 | 0.001(S) |
| 5 Minutes after Extubation | 70.15 | 2.24 | 86.86 | 7.87 | 0.001(S) |
| PACU | 78.60 | 5.10 | 89.66 | 7.78 | 0.001(S) |

From the above table it is evident that Mean blood pressure has been significantly lower in dexmedetomidine group throughout the intraoperative period in comparison to M group (P value<0.05)

**Table 3:** Comparison of Boezaart Bleeding Score between two groups

| Boezaart Bleeding Score | Group D | | Group M | | p-value |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| | 1.30 | 0.73 | 3.80 | 0.83 | 0.001(S) |

From the above table it is evident that after administration of dexmedetomidine there is significant reduction of bleeding in D group.

**Table 4:** Comparison of Surgeon's Satisfaction SCORE between two groups

| Surgeon's Satisfaction Score | Group D | | Group M | | p-value |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| | 3.35 | 0.67 | 2.55 | 0.60 | 0.001(S) |

From the above table it is evident that after administration of dexmedetomidine there is superior surgeon's satisfaction.

## 5. Discussion

Transsphenoidal resection of pituitary adenoma poses unique challenges to the anaesthesiologist. Pituitary gland is a master endocrine gland of theneuroendocrine axis having a central role in various hormone secretion and reproduction cycle maintenance. Pituitary tumour is common. It present

clinically as hormone hypersecretionsyndrome or hyposecretion although most of the tumors were incidental finding on CT scan or at autopsy. Pituitary adenomas were of two types i.e. macroadenomas (> 10mm) and microadenomas (<10mm)[6,7]. Transsphenoidal resection is associated with wide hemodynamic changes likeincrease in blood pressure and heart rate. It is due to transnasal approach. For that intranasal adrenaline is injected. It causes hypertension and tachycardia. Moreover nasal speculum insertion and sellar dissection causes widehemodynamic changes intraoperatively. To prevent this sympathetic activity andprovide hemodynamic stability various agents like beta blockers, sodium nitroprusside, nitroglycerine, CCB and inhalational anaesthetics are widely used. Alpha 2 agonists like dexmedetomidine andclonidine are used because of their anxiolytic, sedative, sympatholytic andanalgesic sparing properties. Magnesium sulphate is also used during transsphenoidal resection because of its analgesic, sedative and muscle relaxantproperties. It blocks N type calcium channel and prevent release of norepinephrine[8]. We have conducted this prospective randomized blinded study in an attempt to examine effect of dexmedetomidine and magnesium sulphate in providing hemodynamic stability and good, clear surgical field during endoscopictrans nasal transsphenoidal pituitary adenoma resection.

Centrally acting alpha-2adrenergic agonists including dexmedetomidine activate receptors in themedullary vasomotor center[8], reducing norepinephrine release and decreasingsympathetic outflow, resulting in alteration in sympathetic function. It providesbetter hemodynamic and adrenergic stability via sympatholytic action, sedation, anxiolysis, decrease anaesthetics and analgesic consumption without ventilator depressing effects. Symptholytic effect of alpha 2 agonist is not related to changes in neurotransmiter synthesis, storage and metabolism and is reversiblewith vasoactive agents, antagonists of these receptors or simply by withdrawingthe drug. Further dexmedetomidine also attenuates adrenergic response to tracheal intubation.

Magnesium sulphate exerts its effect by blocking N type calcium channel[9]. Itdecreases norepinephrine release and causes vasodilatation in both the systemicand pulmonary circulations. Vasodilatory action is through its effect onmembrane channels involved in calcium flux and through its action in thesynthesis of cyclic AMP[9]. Magnesium sulphate has analgesic properties, primarily related to the regulation of calcium influx into cells and an antagonist of NMDA receptors in the CNS[9,10]. Its use during intraoperative period causes reduction in post operative opioid requirements.

**Hemodynamic Parameters**

In our study we have observed heart rate and mean blood pressure duringintraoperative and postoperative period in patients of both the study groups. Fromthe observation we have seen that after starting dexmedetomidine infusion in group D there has been a decrease in heart rate and blood pressure compared togroup M. This decrease in blood pressure causes less bloodloss and clear surgical field in group D compared to group M.

Shimosawa T, Takano K, Ando K, Fujita T[5] evaluate the effect of magnesium sulphate on sympathetic tone and blood pressure. They concluded thatmagnesium sulphate is better in causing hypotension during the surgery.

Bayram A, Ulgey A[11] in comparative study for controlled hypotension of dexmedetomidine and magnesium sulphate found that bleeding score and meanarterial pressure was significantly lowered in dexmedetomidine group comparedto magnesium sulphate.

Salimi A, Sharifi G, Bahrani[13] H, 2017 concluded that dexmedetomidine is useful drug to improve surgical aspects of transsphenoidal resection of pituitaryadenoma. Their results showed less bleeding and superior surgeon's satisfaction.51

Gopalkrishna KN[12] conducted study in 46 patients using dexmedetomidine as an anaesthetic adjuvant in transnasal transsphenoidal pituitary adenoma resection compared with control group receiving 0.9% saline. They concluded that there was hypotesion and bradycardia among dexmedetomidine group. Moreover emergence timewas significantly lowered with dexmedetomidine.

**Blood loss and surgeon's satisfaction:**

In our study we have compared blood loss using boezaart bleeding score. We have observed less bleeding due to controlled hypotension with dexmedetomidine compared to magnesium sulphate. Surgeon's satisfaction score was also compared between two groups and we have observed that superior surgeon's satisfaction with dexmedetomidine compared to magnesium sulphate. Complicationssuch as hypotension and bradycardia were seen in two orthree patients in group D which was managed withinjection atropine IV and fluids.There are some limitations of our study. We have limited duration for the studywith limited patients,so we recommend other studies to be done to compare thehemodynamic parameters and side effects of dexmedetomidine and magnesiumsulphate on patients undergoing transnasaltranssphenoidal resection of pituitary adenoma.

Gopalakrishna, KN[12] also observed reduction in bleeding due to controlled hypotension with dexmedetomidine in patients undergoing transnasaltranssphenoidal resection of pituitary adenoma. They had founded excellentsurgical satisfaction while using dexmedetomidine.

Salimi A[13] study results showed less bleeding and superior surgeon's satisfactionin patients receiving dexmedetomidine during transsphenoidal resection of pituitary adenoma.

## 6. Conclusion

Effects of dexmedetomidine and magnesium sulphate on heart rate, mean blood pressure and in providing surgical bloodless field using boezaart bleeding score have been compared. Surgeon's satisfaction score was alsocompared among two groups.From our results we conclude that dexmedetomidine has advantage of causing controlled hypotension and reduction in heart rate with minimal blood loss compared to magnesium sulphate. Both these drugs are

safe in transnasal transsphenoidal resection of pituitary adenoma surgery.

## References

[1] Jane JA Jr., Sulton LD, Laws ER Jr. Surgery for primary brain tumours atUnited States academic training centers: Results from the Residency ReviewCommittee for neurological surgery. J Neurosurg 2005; 103:789-93.
[2] Nemergut EC, Dumont AS, Barry UT, Laws ER. Perioperative management of patients undergoing transsphenoidal pituitary surgery. AnesthAnalg2005; 101:1170-81.
[3] Virtanen R, Savola JM, Saano V, Nyman L: Characterization of selectivity, specificity and potency of dexmedetomidine as an alpha 2-adrenoceptor agonist. Eur J Pharmacol 1988; 150:9-14.
[4] Elsharnouby NM, Elsharnouby MM. Magnesium sulphate as a technique of hypotensive anaesthesia. Br J Anaesth 2006; 96:727-31.
[5] Shimosawa T, Takano K, Ando K, Fujita T. Magnesium inhibits norepinephrine release by blocking N-type calcium channels at peripheral sympathetic nerve endings. Hypertension 2004; 44:897-902.
[6] Vivek K. Moitra, STOELTING'S Pharmacology and Physiology in Anaesthetic Practice,5th edition, chapter 37, page number-733.
[7] Udelsman R, NortonJA,JelenichSE, et al. Responses of the hypothalamicpituitary- adrenal and angiotensin axis and the sympathetic system duringcontrolled surgical and anesthetic stress. JClin Endocrinol Metab.1987;64:986 994.
[8] Savola JM, Ruskoaho H, Puurunen J, Salonen JS, Kärki NT: Evidence for medetomidine as a selective and potent agonist at alpha 2-adrenoreceptors. J Auton Pharmacol 1986; 6:275-84.
[9] Iseri LT, French JH. Magnesium:nature's physiologic calcium blocker. Am Heart J.1984;108(1):188-193.
[10] Woolf CJ, Thompson SW. The induction and maintenance of central sensitization is dependent on N-methyl-D-aspartic acid receptor activation; implications for the treatment of post-injury hypersensitivity states. Pain.1991;44(3):293-299.
[11] Bayram A, Ulgey A, Günes I, Ketenci I, Capar A, Esmaoglu A, et al. Comparison between magnesium sulfate and dexmedetomidine in controlled hypotension during functional endoscopic sinus surgery. Rev Bras Anestesiol 2015;65:61-7.
[12] Gopalakrishna KN, Dash PK, Chatterjee N, Easwer HV, Ganesamoorthi A.58 Dexmedetomidine as an anesthetic adjuvant in patients undergoing transsphenoidal resection of pituitary tumor. J Neurosurg Anesthesiol 2015; 27: 209-15.
[13] Salimi A, Sharifi G, Bahrani H, Mohajerani SA, Jafari A, Safari F, et al. Dexmedetomidine could enhance surgical satisfaction in trans-sphenoidalresection of pituitary adenoma. J NeurosurgSci 2017;61:46-52.