Comparative Evaluation of Dexmedetomidine Versus Magnesium Sulphate on The Adequacy of Hypotensive Anesthesia and Post-Operative Recovery for Patients Undergoing Endoscopic Transnasal Transsphenoidal Pituitary Tumor Resection

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ABSTRACT

Background: Perioperative use of magnesium sulfate ($MgSO_4$), dexmedetomidine, have been tried in order to provide beneficial clinical effects during general anesthesia (GA). However, few literature discussed it with varying results. Several clinical researches have showed that usage of $MgSO_4$ infusion was associated with a reduction in anesthetic requirement and postsurgical analgesic consumption during GA.

Objective: This study aimed to assess the pharmacologic effects of the use of dexmedetomidine and $MgSO_4$ on anesthetic requirement, intra operative haemodynamics stability and postsurgical analgesic effects on the adequacy of hypotensive anesthesia during transsphenoidal resection of pituitary tumours.

Patients and methods: A total of 110 cases were enrolled in this prospective study. They were randomized into 2 groups: Group D (55 cases) that was commenced on dexmedetomidine, and group M (55 cases) which received $MgSO_4$

Results: The mean values of Boezaart score were significantly decreased in Group D in comparison to group M. In addition, isoflurane and propranolol consumption showed a significant decrease in group D. However, blood loss showed no significant difference when comparing the same groups. Group D expressed significantly longer emergence and extubation times compared to Group M.

Conclusion: Dexmedetomidine appears to be superior compared to magnesium sulphate in achieving hypotensive anesthesia during pituitary surgery.

Key words: Dexmedetomidine; Magnesium sulphate; Hypotensive anesthesia; Pituitary surgery.

INTRODUCTION

Neuroanesthesia has some basic principles including smooth induction, hemodynamic stability, maintaining cerebral perfusion, and providing optimal operative conditions to facilitate good exposure for the surgeon. Smooth emergence is of great importance such as smooth induction as it allows early evaluation of the neurological functions after surgery [(1)].

Trans-sphenoidal excision of pituitary tumours is a common neurosurgical approach, as it accounts for 20% of all intracranial operations in most neurosurgical centers [(2)]. Anesthetic management for such cases represents a challenge to anesthesiologists as nasal speculum insertion during the procedure results in a strong nociceptive stimulation, which in turn will lead to tachycardia and hypertension. This will lead to bleeding and difficult visualization of the operative field [(3, 4)].

Multiple drugs are recommended to obtain controlled hypotension during neurosurgical procedures including; beta-blockers, sodium nitroprusside, nitroglycerine, increasing the dosages of inhaled anesthetic agents, alpha-2 agonists and $MgSO_4$ [(5)].

Dexmedetomidine is an alpha-II adrenergic agonist, which has sedative and analgesic, as well as anesthetic sparing effect, without any negative impact on the respiratory center. It modulates pin signals transmission via acting on both spinal and supraspinal regions [(1)]. Dexmedetomidine is associates with decrease of inhaled anesthetic requirements. Additionally, in neurosurgical patients, it helps to stabilize intracranial pressure along with intraoperative hemodynamic stability especially on intubation and extubation. It also to decreases anesthetic and opioid consumption [(6)].

Magnesium sulfate ($MgSO_4$) is a NMDA receptor antagonist with antinociceptive effects [(7)]. It has the ability to induce deliberate hypotension by blocking of trans-membrane calcium ATPase and Na^+/K^+-ATPase ion channels. In addition, Mg^{++} suppresses the discharge of norepinephrine. It also has a direct vasodilator effect by increasing prostacyclin synthesis, as well as inhibiting ACE activity. A lot of investigations have displayed that $MgSO_4$ infusion throughout general anesthesia was accompanied by a reduction in anesthetic need and postsurgical analgesic requirement [(8)].

The current study aimed to compare between dexmedetomidine and $MgSO_4$ in the context of adequacy of hypotensive anesthesia during trans-sphenoidal excision of pituitary tumours.

PATIENTS AND METHODS

This was a prospective randomized study carried out at Mansoura University Hospitals within a period of two years, starting from December 2018 till December 2020.

Inclusion criteria: Age from 18 and 65 years who were electively prepared for pituitary tumour resection.

Exclusion criteria: patients with Glasgow Coma Scale (GCS) < 15, American Society of Anesthesiologists (ASA) score > II, preoperative hear rate < 50 bpm, first- or second-degree heart block, allergy to the study

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medications, pregnancy and patients commenced on beta blockers, alpha-methyl dopa, clonidine, or other alpha-2 agonists.

Sample size was measured according to a prior research [9], where at the time of nasal speculum insertion, the rising in MAP was 9.4% in dexmedetomidine group, on G power to determine a change of twenty percent in MAP among the magnesium sulphate and the Dexmedetomidine groups. The needed number for α error of 0.05 and power of eighty percent was measured to be 55 cases in each group.

This study was carried out on two groups:

Group D: included 55 cases who were commenced on dexmedetomidine (1mcg/kg over ten min then, a maintenance of 0.5 mcg/kg/hr), and

Group M: included the remaining 55 cases who received $MGSO_4$. In (M group), cases received 40 mg/kg $MgSO_4$ in 100 ml saline solution over ten min as the IV loading dosage 10 min prior to induction, with a consequent 10–15 mg/kg/h infusion throughout the operation.

Both drugs were prepared by a staff nurse and an anesthesiologist who were blind to both drug and patient allocation. Both of these regimens were started ten min before anesthetic induction.

At neurosurgical operative theater, the standard patient monitoring was ensured including noninvasive arterial pressure, pulse and oxygen saturation. Additionally, an intravenous line was established. Before induction, midazolam (0.03 mg/kg), fentanyl (1 mic/kg) were given to all cases. Induction of anesthesia was done by propofol (0.5 – 2 mg/kg), while atracurium (0.5 mg/kg) was used for neuromuscular blockade. Then, direct laryngoscopy with insertion of the proper size endotracheal tube was done.

Anesthesia was kept with air in oxygen (50%:50%) and isoflurane. IPPV with a TV of 7 to 8 ml/kg BW was performed to keep end tidal CO_2 between 30 and 35mm Hg. Also, a moist cotton gauze was used to pack the posterior pharynx under direct laryngoscopy. If any rise in the HR or MBP > 20%, compared to the baseline, the initial isoflurane 0.5% end-tidal level was raised by 0.2% every four minutes up to a maximum of 2% end-tidal level. If no response was detected, either nitroglycerine (increment 0.1-0.25 mg) or propranolol (increment 0.5 up to 2 mg) was administered.

Both blood pressure and pulse were measured and monitored. They were recorded at the next time points; baseline, before intubation, following intubation, insertion of nasal speculum, at 15 minutes, 30 minutes, then after 30 minutes till end of surgery, pre-extubation, and post-extubation. If hypotension was detected (defined as systolic blood pressure < 90 mmHg), ephedrine 5 mg was given by IV route. Besides, bradycardia, described as HR below 50 bpm, was managed by intravenous atropine (0.02 mg/kg).

Boezaart bleeding scale was utilized to assess the quality of surgical field regarding bleeding as follows; (0) virtually bloodless field, (1) slight oozing for which suctioning isn't essential, (2) minimal bleeding requiring occasional suctioning with no interference with the surgical field, (3) moderate bleeding requiring usual suctioning that improves the visual field, (4) heavy bleeding with regular suctioning, and the surgical field worsens following suction was withdrawn, (5) extensive uncontrollable blood loss faster than suctioning [10].

Blood loss, fluid intake, and UOP were measure and recorded. Both $MgSO_4$ and dexmedetomidine were stopped ten min prior to the termination of operation, which was described as the time point once the neurosurgeon removed the nasal speculum. After that, isoflurane was ceased, and neuromuscular blockade was backed by utilizing both neostigmine and atropine. The total doses of isoflurane, propranolol, and nitroglycerine were calculated and recorded. Total isoflurane dose was calculated as recommended by Biro [11]. Additionally, both emergence and extubation times were recorded. All patients were then moved to the PACU, where observation was continued by an examiner and PACU nurse, neither of whom was aware of the anesthetic regimen. Post-operative pain was evaluated by VAS, with 0 for no pain, and 10 for the worst pain ever [12] at 15, 30, and 60 min following tracheal extubation. If VAS was > 40, ketorolac 30 mg IV was given.

Entire cases were discharged when reaching a score of nine by utilizing a modified Aldrete scoring system as shown in table (1).

Table (1) Modified Aldrete Score (MAS) [13]

Criteria	Characteristics	Points
Activity	Able to move 4 extremities	2
	Able to move 2 extremities	1
	Unable to move extremities	0
Respiration	Able to breathe deeply and	2
	Dyspnea or limited breathing	1
	Apneic	0
Circulation	BP +/- 20% of pre-anesthetic	2
	BP +/- 20-49% of pre-	1
	BP +/- 50% of pre-anesthetic	0
Consciousness	Fully awake	2
	Arousable on calling	1
	Not responding	0
Oxygen saturation	Able to maintain O2	2
	Needs oxygen to maintain	1
	O2 saturation <90% even	0

Comparing intraoperative hemodynamic parameters along with Boezaart bleeding scale were our primary outcomes. Secondary outcomes included inhalational anesthetic requirement, hypotensive agent doses required, emergence time, extubation time, post-operative pain, and analgesic requirements.

Ethical consent:

The approval of the study was got from IRB of Faculty of Medicine, Mansoura University prior beginning the research and an informed written

consent was taken from each participant in the study. Number of ethical approval is R.20.08.966. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

The researcher elucidated the objective and aim of the study to the subjects involved within study. The researcher guaranteed keeping anonymity and confidentiality of the subject's data. Subjects were told that they were allowable to choose to share or not in the research and that they had the right to leave the research at any time without explaining causes.

Statistical analysis

IBM's SPSS statistics for windows (version 20) was utilized for assessment of the gathered information. **Shapiro-Wilk test** was used to check the normality of the data distribution. Quantitative variables were expressed as mean ± SD, whereas categorical variables were expressed as frequency and percent. **Independent sample T and Mann Whitney tests** were utilized for comparison of parametric and non-parametric continuous data correspondingly. In terms of pair-wise comparison of data, the follow up values were compared to the matching basal level by utilizing paired samples T test or Wilcoxon matched pairs signed ranks test. **Fisher exact and Chi square** tests were utilized for inter-group comparison of nominal data by utilizing the crosstabs functions. $P \leq 0.05$ is considered significant.

RESULTS

This was a prospective randomized study carried out at Mansoura University hospitals during a period of two years, starting from December 2018 till December 2020. This study was carried out on two groups: Group D: included 55 cases who were commenced on dexmedetomidine and Group M: included the remaining 55 cases who received $MGSO_4$. Starting with demographics, age and sex weren't significantly different among both groups (p=0.640 and 0.565 correspondingly). The mean age of the comprised cases was 46.62 and 45.75 years in groups D and M correspondingly. Males represented 58.2 and 52.7% of the included population in both groups correspondingly. Additionally, the mean values of BMI were 30.1 and 29.77 kg/m^2 in the study groups correspondingly (p = 0.693). Diabetes mellitus was present in 3.6 and 9.1 of cases, whereas hypertension was prevalent in 20 and 18.2% of cases in the same groups correspondingly. Operative time didn't significantly differ between the studied groups (160.91 and 153 minutes correspondingly – p = 0.155) as demonstrated in table (2).

Table (2): Sociodemographic features, medical history and operative duration of the study groups

		Group D (n= 55)	Group M (n= 55)	95% CI	p
Age (years)		46.62 ± 8.272	45.75 ± 11.029	-2.8, 4.6	0.640
Gender	**Male**	58.2% (32)	52.7% (29)		0.565
	Female	41.8% (23)	47.3% (26)		
BMI (kg/m^2)		30.10 ± 4.408	29.77 ± 4.378	-1.3, 2.0	0.693
History of DM		3.6% (2)	9.1% (5)		0.438
History of HTN		20.0% (11)	18.2% (10)		0.808
Operative duration (minute)		160.91 ± 29.644	153.00 ± 28.196	- 3.0, 18.8	0.155

Although basal heart rate didn't show significant differences between both groups (p = 0.290), most of the following readings showed significantly lower hear rates in group D in comparison with group M ($p < 0.05$) as illustrated in table (3).

Table (3): Basal and follow up values of HR (beat per minute) of the study groups

Heart rate	Group D (n= 55)	Group M (n= 55)	95% CI	p
Basal	85.38 ± 7.529	87.02 ± 8.565	-4.7, 1.4	0.290
Drug infusion	82.04 ± 7.338	84.75 ± 8.438	-5.7, 0.3	0.075
Before intubation	69.76 ± 7.608	82.62 ± 8.489	-15.9, -9.8	**< 0.001**
After intubation	63.33 ± 9.862	83.75 ± 8.765	-23.9, -16.9	**< 0.001**
Speculum insertion	63.07 ± 9.903	83.58 ± 9.028	-24.1, -16.9	**< 0.001**
15 minutes	62.96 ± 10.132	83.42 ± 8.908	-24.1, -16.8	**< 0.001**
30 minutes	63.20 ± 10.853	82.87 ± 9.111	-23.5, -15.9	**< 0.001**
60 minutes	62.91 ± 10.814	83.22 ± 10.208	-24.3, -16.3	**< 0.001**
90 minutes	62.67 ± 10.844	82.65 ± 10.442	-24.0, -16.0	**< 0.001**
120 minutes	62.61 ± 10.931	83.53 ± 10.724	-25.1, -16.7	**< 0.001**
150 minutes	62.83 ± 11.878	83.34 ± 10.190	-25.8, -15.3	**< 0.001**
180 minutes	62.80 ± 14.088	84.00 ± 9.390	-30.3, -12.1	**< 0.001**
210 minutes	55.00 ± 24.042	86.67 ± 1.528	-72.2, 8.8	0.089
Pre-extubation	62.91 ± 11.546	82.76 ± 10.770	-24.1, -15.6	**< 0.001**
Post-extubation	62.91 ± 11.699	84.80 ± 11.697	-26.3, -17.5	**< 0.001**

MAP values didn't significantly differ between both groups either at the baseline or during drug infusion. However, the following readings showed that group D expressed significantly lower MAP values compared to the other group as shown in table (4).

Table (4): Basal and follow-up values of MAP (mmHg) of the study groups

MAP	Group D (n= 55)	Group M (n= 55)	95% CI	p
Basal	98.18 ± 4.750	97.07 ± 4.086	-0.6, 2.8	0.192
Drug infusion	94.27 ± 5.523	95.96 ± 4.872	-3.7, 0.3	0.091
Before intubation	84.29 ± 7.099	88.93 ± 5.878	-7.1, -2.2	**< 0.001**
After intubation	82.27 ± 8.031	91.71 ± 7.305	-12.3, -6.5	**< 0.001**
Speculum insertion	77.85 ± 7.663	91.75 ± 7.594	-16.8, - 11.0	**< 0.001**
15 minutes	77.78 ± 7.932	92.20 ± 7.936	-17.4, -11.4	**< 0.001**
30 minutes	77.91 ± 8.307	92.09 ± 8.336	-17.3, -11.0	**< 0.001**
60 minutes	77.96 ± 8.583	91.75 ± 8.596	-17.0, -10.5	**< 0.001**
90 minutes	77.85 ± 8.864	91.67 ± 8.428	-17.1, -10.5	**< 0.001**
120 minutes	77.86 ± 8.591	92.07 ± 8.813	-17.6, -10.9	**< 0.001**
150 minutes	77.93 ± 8.658	91.25 ± 6.979	-17.1, -9.6	**< 0.001**
180 minutes	79.40 ± 7.500	89.85 ± 5.352	-15.4, -5.5	**< 0.001**
210 minutes	80.00 ± < 0.001	94.33 ± 4.041	-23.9, -4.7	**0.018**
Pre-extubation	77.82 ± 9.145	92.18 ± 7.818	-17.6, -11.1	**< 0.001**
Post-extubation	81.93 ± 10.274	99.31 ± 9.379	-21.1, -13.7	**< 0.001**

The mean values of Boezaart score were significantly lower in group D in comparison with group M (1.43 vs. 1.57 correspondingly-p=0.033). In addition, isoflurane and propranolol consumption showed a significant decrease in group D ($p < 0.001$). Nevertheless, blood loss demonstrated no significant difference when comparing the same groups (p=0.093). Also, neither intraoperative fluid intake nor urine output was significantly different between both studied groups ($p = 0.616$ and 0.225 correspondingly). Additionally, group M expressed significantly shorter emergence and extubation times compared to group D. However, cases in the same group expressed significantly higher VAS values ($p = 0.018$)) as illustrated in table (5).

Table (5): Intra-operative isoflurane, propranolol and nitroglycerine consumption, Boezaart score, fluid intake, urine output, blood loss, emergence and extubation times, post-operative VAS score and morphine requirements of the groups

	Group D (n= 55)	Group (n= 55)	95% CI	p
Boezaart	1.43 ± 0.4325	1.57 ± 0.369	-0.3, 0.0	**0.033**
Isoflurane consumption (ml)	51.64 ± 11.509	61.45 ± 15.446	-14.97, - 4.67	**< 0.001**
Propranolol consumption/per patient	0.31 ± 0.245	0.96 ± 0.383	-0.78, -0.53	**< 0.001**
Intraoperative fluid intake (ml)	1556.36 ± 376.02	1522.73 ± 322.72	-98.8, 166.1	0.616
Urine output (ml)	740.91 ± 230.55	692.73 ± 180.12	-30.0, 126.4	0.225
Blood loss (ml)	230.45 ± 52.19	249.09 ± 62.54	-40.4, 3.1	0.093
Emergence time (minute)	10.27 ± 2.670	7.47 ± 2.176	1.9, 3.7	**< 0.001**
Extubation time (minute)	13.62 ± 2.812	10.58 ± 2.580	2.0, 4.1	**< 0.001**
VAS at discharge from PACU	2.18	1.85	0.1,0.6	0.018
Time to discharge	38.3 (5.2)	60.7 (6.8)*	0.02, 0.82	**0.040**

DISCUSSION

As earlier clinical investigations have pointed to the efficacy of dexmedetomidine as a sedative in cases with critical illness, newer researches have focused on the efficacy of alpha-2 receptor agonists as adjuvants to neuroanesthesia. Dexmedetomidine has multiple favorable clinical effects including hemodynamic stability, neuroprotection, and lack of respiratory depression without any interference with intraoperative neurophysiological monitoring. These suggested that dexmedetomidine could be useful in terms of neurosurgical patients treatment [(14)].

The current study was carried out at to compare between dexmedetomidine and $MgSO_4$ on the adequacy of hypotensive anesthesia during transsphenoidal excision of pituitary tumors. A total of 110 cases was enrolled, and they were divided into 2 groups: Group D (55 cases) that was commenced on dexmedetomidine, and group F (55 cases), which received fentanyl.

No significant changes were detected between both studied groups as regards demographic characteristics, and this should nullify any bias that may have skewed results in favor of one group rather than the other one. Another study that evaluated the efficiency of dexmedetomidine in maintaining hemodynamic stability in cases with pituitary surgery also reported no significant change among both studied groups as regards patient' demographics ($p > 0.05$) [(9)].

The present study demonstrated that group D tended to have lower heart rates and mean arterial pressures compared to group M although no significant difference existed regarding their baseline values. Similarly, **Bala *et al.*** [(9)] recorded that dexmedetomidine administration was associated with a significant

decrease in both MAP and HR compared to controls in spite of being comparable at baseline. **Batra *et al.*** [1] also reported that both heart rate and BP readings had lower values in the dexmedetomidine group in comparison with controls throughout most intraoperative readings although both groups had no significant difference prior to operation. Moreover, other researches have confirmed our findings as regards the effectiveness of dexmedetomidine in maintaining hemodynamic stability in pituitary surgeries [15, 16].

Cardiovascular response in the form of tachycardia and hypertension is occasionally encountered in multiple intracranial surgeries. About 50 – 90% of such cases will require perioperative antihypertensive agents to control blood pressure [17, 18]. Due to severe nociceptive stimuli experienced by the patients during trans-sphenoidal pituitary surgeries, the anesthesiologist often encounters perturbations in heart rate and BP during multiple surgical stages. This will require increasing the anesthesia or increasing opioid administration, which was demonstrated to be associated with hypotension with compromise of the cerebral circulation. Besides, these maneuvers are associated with prolonged recovery time [15, 19]. A previous Egyptian study has compared dexmedetomidine to fentanyl in cochlear implant surgery. Authors reported that group D expressed significantly lower heart rates and MAP during operation compared to the fentanyl group [20]. This also coincides with our results.

Multiple previous researches have confirmed the efficacy of dexmedetomidine in attenuating the changes of intraoperative hemodynamics. Therefore, it gained a great popularity in neurosurgical procedures [21-23]. These effects could be clarified by its central and peripheral actions. With regard to CNS, it decreases the sympathetic outflow. Additionally, it blocks peripheral ganglia. Both of the previous mechanisms could explain its protective effect on hemodynamic changes during neurosurgical procedures [9]. The previous reports emphasize the importance of dexmedetomidine as adjunctive to general anesthesia in such cases, as it decreases the occurrence of hypertensive episodes, which can lead to bleeding, edema, worsening of surgical field, and increase of intracranial pressure [18].

In the current study, the mean values of Boezaart score were significantly decreased in group D in comparison with group M (1.43 vs. 1.57 correspondingly – $p = 0.033$). Likewise, **El Saied and his colleagues** [20] reported that the surgical field quality was significantly better in the dexmedetomidine group ($p=0.011$). Quality scale had mean values of 2.19 and 2.76 in the dexmedetomidine and fentanyl groups correspondingly. Other authors reported that dexmedetomidine administration was associated with significantly higher surgeon satisfaction [16]. These effects are secondary to better hypotensive anesthesia with dexmedetomidine, which leads to decrease tissue oozing during surgical dissection especially in narrow surgical fields like that encountered in neurosurgical practice. In accordance **Faranak and his colleagues** [24] have demonstrated that blood loss was minimal and the surgeon's satisfaction score was greater in the dexmedetomidine group in comparison with $MgSO_4$ group [24]. Also, **Bayram and his colleagues** [25] compared the efficiency of $MgSO_4$ and dexmedetomidine in the context of hypotension in FESS operations and demonstrated that dexmedetomidine was associated with a greater degree of surgeon's satisfaction in comparison with the $MgSO_4$ group [25]

In our study, group D had significantly lower isoflurane consumption in comparison with group M (51.64 vs. 61.45 ml correspondingly – $p < 0.001$). Dexmedetomidine is associated with decreased inhalation anesthetic requirement because of its alpha-II agonist actions that suppress norepinephrine transmission [26, 27]. Its sedative effect is associated with a 35 – 50% reduction in intraoperative isoflurane requirements [28]. This was documented in three previous researches that reported that Dexmedetomidine administration led to decreased inhalation anesthetic intake [9, 29, 30]. Of course, this will lead to a faster and better recovery from anesthesia, which will allow early assessment of the patient's neurological functions after operation.

Although statistical analysis didn't reveal any significant change among both studied groups in the context of intraoperative blood loss ($p = 0.93$), group D tended to have less blood loss during surgery (230.45 vs. 249.09 ml in group M). **Bala and his associates** [9] also negate any significant difference among both groups as regards estimated blood loss. However, it had mean values of 153.3 and 218 ml in the dexmedetomidine and control groups respectively. Despite its statistical insignificance, it was evident that blood loss was higher in the controls [9]. Conversely, another study reported that dexmedetomidine was accompanied by a significant decrease in intraoperative bleeding ($p = 0.012$). It had mean values of 160 and 305 ml in dexmedetomidine and control groups correspondingly [16].

We have demonstrated that, propranolol administration was significantly decreased in group D compared to group M (0.31 vs. 0.96 correspondingly – $p < 0.001$). In another randomized study, dexmedetomidine infusion was accompanied by a significant decrease in the administration of antihypertensive medications comprising beta blockers and hydralazine [23]. This comes in line with our findings.

Our findings revealed that group D expressed significantly longer emergence and extubation times compared to group M. Both early emergence and tracheal extubation are crucial for neurosurgical anesthesia. These parameters were significantly increased with dexmedetomidine. In agreement, **Faranak and his colleagues** [24] have demonstrated that

cases in the dexmedetomidine group were more sedated at the PACU. In addition, the period to reach MAS ≥ nine was longer in comparison to those of the $MgSO_4$ group. Also, **Erdem and his colleagues** [31] have displayed that, the sedation score was greater when dexmedetomidine was given to induce hypotension throughout FESS in comparison to esmolol. **Gunes and his associates** [32] noted delayed recovery after intracranial surgery in patients administered dexmedetomidine. **Tanskanen and his colleagues** [18] were on contrary and noted that the dexmedetomidine infusion was associated with faster recovery from GA. They also reported no cases with respiratory depression that may delay patient recovery. It should be noted that this difference between researches could be attributed to the different dose and infusion rate. Higher doses might have caused over sedation, which led to delayed recovery.

In the present study, the postoperative VAS pain score in D group was significantly less than in M group. Thus, dexmedetomidine was demonstrated to have a better analgesic effect in companion with $MgSO_4$. In concurrence to these results **Faranak *et al.*** [24] study showed less analgesic was needed in the dexmedetomidine group in comparison with the $MgSO_4$ group.

Dong and his colleagues [33] evaluated the effect of adding dexmedetomidine to a sufentanil-based analgesics for postsurgical pain management in the context of spine surgeries, and they demonstrated that dexmedetomidine was associated with a minimal opioid requirement and satisfactory pain management throughout postsurgical period. On the other hand, **Abo shanab and his colleagues** [34] conducted a study to compare between both medications in the context of middle ear surgery. They reported that only 16% of patients in the $MgSO_4$ group and 14% of cases in the dexmedetomidine group needed rescue analgesics. Such outcomes could be clarified by the analgesic effects of both studies' medications [34]. **Peng and his colleagues** [35] evaluated the effect of IV $MgSO_4$ on postsurgical analgesia for orthopedic surgeries and reported that perioperative IV administration of $MgSO_4$ could decrease postsurgical analgesic consumption and decrease postsurgical pain [35]. The analgesic effects of magnesium are owing to blocking Ca^{++} channels and antagonism of the NMDA receptor and enhancement of opioids effect in the CNS. This effect was first noticed in patients with malignant tumours managed with morphine. These different results could be explained by the difference between researches in the dose and infusion rate of the studied drugs. Even both drugs had analgesic effect. It appears that dexmedetomidine has a more potent analgesic effect in comparison with $MgSO_4$.

Our study had multiple limitations where it had a small sample size. Also, the efficacy of dexmedetomidine in cases with pre-existing heart disease should be researched. In addition, stress hormone levels (like cortisol) should be evaluated as well. These drawbacks should be well covered in the upcoming researches.

CONCLUSION

Based on our findings, Dexmedetomidine appears to be superior compared to magnesium sulphate in achieving hypotensive anesthesia during pituitary surgery. It is associated with lower heart rate, mean arterial pressure, Boezaart score. It also had better post-operative analgesic effect while magnesium sulphate had better recovery.

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