Original Research Article

Use of dexmedetomidine in monitored anaesthesia care for burr hole and evacuation of chronic sub-dural haematoma: A comparison with general anaesthesia

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Abstract

Background: Burr-hole craniotomy surgery is commonly used for evacuation of Chronic sub dural haematoma. Either Local anaesthesia with sedation or General anaesthesia is used for such cases. Monitored Anaesthesia Care has been advocated as safer tool. Dexmedetomidine has sedation without respiratory depression, analgesia and sympatholytic effect which make it an attractive agent for sedation during MAC. **Methods**: Total 60 patients were randomized in 2 equal groups: Group D received a loading dose of 0.7mcg/kg of dexmedetomidine over 10 minutes intravenously followed by a maintenance infusion of 0.5 mcg/kg/h, infiltration with 2 ml of injection 0.5% bupivacaine and 2 mL of injection 2% lignocaine at each burr hole site. In Group G: intubation with balanced general anesthesia given. **Results:** Mean time to recovery from anesthesia was less in group D (12.67±3.14 versus 18.40±5.04; p<0.001) but no significant changes in anesthesia onset time, total duration of surgery total duration of hospital stay.. The hemodynamic changes were significantly more in group G as compared to group D at the time of induction, after 5 minutes of induction and at the time of extubation. Overall postoperative complications were significantly more (P= 0.041) in the group G as compared with group D. **Conclusion: U**se of dexmedetomidine is effective and safe for surgical evacuation of chronic subdural hematoma via burr hole craniotomy.

Key words: Burr-hole craniotomy, chronic sub dural haematoma, dexmedetomidine, hemodynamic, postoperative complications.

Introduction

Chronic sub-dural haematoma (CSDH) is one of the common clinical entity in elderly patients and patients with multi-system disorders. and is one of the most frequently encountered intracranial hemorrhages in neurosurgery. Though it can be seen in any age group, but the etiopathogenesis of this disease makes it more common in old or elderly patients due to normal atrophy of cerebral hemispheres making the draining veins more vulnerable to get ruptured with trivial trauma. Burr-hole surgery is commonly used for its initial treatment. Both General anaesthesia (GA) and Local anaesthesia (LA) can be used for surgical treatment of chronic sub-dural haematoma[1-2].

Previously this burr hole surgery was performed under LA only and lot of problems were faced per and post operatively. Many drugs were used for sedation with LA but there were many side effects and complications. So nowadays, this procedure is performed under LA with conscious sedation associated with Monitored Anaesthesia Care (MAC) for its safety and efficacy during the surgery. This form of anaesthesia is considered a middle ground between GA and LA and can facilitate patient comfort and surgical competence during the procedure[3-5].

Drugs such as propofol, opioids, and midazolam have been used for sedation under MAC for a wide variety of surgical and diagnostic procedures. The incidence of adverse reactions, especially respiratory depression, will be increased when used in higher doses or in combination with these sedative agents[6-7]. Dexmedetomidine is highly selective centrally acting alfa 2 agonist, considered to provide "co-operative sedation". It also has many clinical benefits, such as sedation without significant respiratory depression, an analgesic-sparing effect, and a sympatholytic effect that can attenuate the stress response to surgery[8]. These properties along with its relatively short elimination half-life of 2 hour makes dexmedetomidine an attractive agent for sedation during MAC[9].

This clinical study was undertaken to evaluate the efficacy of dexmedetomidine used as adjunctive with LA to achieve the smooth and complication free procedure and not requiring general anaesthesia for that procedure and compare it with the patients done under general anaesthesia.

Material and method

This is a hospital based randomized comparative study conducted at tertiary care hospital attached to medical college. After obtaining institutional ethics committee approval. 60 patients of CSDH were divided in 2 groups with computerized generated randomized tables. Patients included were between 20-80 year with American Society of Anesthesiologist status of I to III, GCS score more than 12, were posted for burr-hole surgery for CSDH. Patients with claustrophobia, psychiatric patients, patients with severe cardiac diseases, patient not willing to give consent and GCS score less than 12 were excluded from the study. The following data were recorded preoperatively: demographic characteristics (age, sex, weight), GCS, ASA grade, history of any medical problems, associated comorbidities, and ongoing medications. Inside the operating room ASA standard monitoring five-lead electrocardiography, NIBP, SpO2, respiratory rate (RR) and temperature were monitored. ETCO2 was also

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monitored after induction of GA/sedation. Baseline heart rate (HR), blood pressure (BP), respiratory rate (RR), and SpO2 were recorded.

In the Group D: patients received a loading dose of 0.7mcg/kg of dexmedetomidine over 10 minutes intravenously followed by a maintenance infusion of 0.5 mcg/kg/h (which was titrated in the range of 0.3 to 0.7 mcg/kg/h) to achieve adequate sedation. All patients received 1 mcg/kg bolus of fentanyl 5 minutes before skin infiltration with 2 ml of injection 0.5% bupivacaine and 2 mL of injection 2% lignocaine at each burr hole site. Supplemental oxygen was administered at 5 L/min through oxygen mask.

The degree of sedation was assessed using Ramsay Sedation Scale (RSS). Once patient was sedated, with a target RSS score of 4, scalp was infiltrated with 2 mL of injection 0.5% bupivacaine and 2 mL of 2% lignocaine injection at each burr hole site. A rescue bolus of propofol (20 mg stat intravenously and repeated to a maximum dose of 50 mg) was administered if patient was not adequately sedated or had inadvertent movement during the procedure. If the patient did not cooperate despite the maximum dose, GA with or without airway intervention was provided and dexmedetomidine sedation procedure was considered as a failure. Once hemostasis achieved and skin closure was commenced, dexmedetomidine infusion was tapered and stopped.

In the Group G:: Anesthesia was induced with intravenous injections of fentanyl 1 mcg/kg, propofol 2 to 3 mg/kg titrated to loss of consciousness, and vecuronium 0.12 mg/kg or atracurium 0.5 mg/kg was given to facilitate tracheal intubation. Anesthesia was maintained with 40% O2 in air and isoflurane to maintain a minimal alveolar concentration of 1. At the end of the procedure, the neuromuscular blockade was reversed with injection neostigmine 0.05 mg/kg and injection glycopyrrolate 0.008mg/kg. Then the patient was extubated after ensuring adequate reversal of muscle power and thorough oral suctioning.

Intraoperatively hemodynamic parameters (HR, NIBP) and respiratory parameters (RR, SpO2, ETCO2) were monitored at 5 minutes, 15 minutes and 30 minutes after induction and also at the time of extubation. In the Dex group since there was no extubation, the corresponding reading was 10 minutes after discontinuation of the infusion. A note was made of any adverse events or complications and the respective treatment given (rescue drugs). After extubating, patients were transferred to the postoperative ward where HR, MAP, SPO2 were recorded.

Bradycardia (defined as HR < 40 bpm) was treated with injection glycopyrrolate 0.2 mg or injection atropine 0.6 mg intravenously. Tachycardia (defined as HR > 120 bpm) was treated with a fluid bolus and injection esmolol 0.5 mg/kg intravenously. Hypotension (mean arterial pressure [MAP] <60 mm Hg) was initially treated with a fluid bolus followed by injection ephedrine 6 mg bolus intravenously, repeated if required to a maximum dose of 12 mg. For hypertension (MAP> 100 mm Hg), injection labetalol 10 mg intravenous bolus was administered.

In Group G post-extubation snoring was treated by oral airway insertion, desaturation was treated by re intubation with ICU admission, stridor was treated by intravenous injection deriphylline and hydrocortisone; and nebulization with salbutamol and budesonide. Restlessness and agitation were treated by injection midazolam. In Group D persistent drowsiness, if present, was managed by observation and no intervention was needed.

In both the groups, anesthesia onset time (i.e., time between the initiation of the anesthesia induction and onset of the surgical procedure), recovery time (in the Group D, time required for eye opening or to achieve RSS 1 to 2 after stopping the dexmedetomidine infusion and in the Group G, after giving reversal time required to eye opening and to achieve RSS 1 to 2). total duration of the procedure, and intraoperative complications were noted. Postoperatively, complications and interventions required to treat them were noted. A note was also made of the duration of hospital stay.

Statistical Analysis

Statistical analysis was performed with the SPSS, version 21 for windows statistical software package (SPSS inc., Chicago, IL, USA). The categorical data was presented as numbers (percent) and were compared among groups using Chi square test. The quantitative data was Presented as mean and standard deviation and were compared by student t- test. Probability was considered to be significant if less than 0.05.

Results

In our study both anesthetic techniques that is MAC with dexmedetomidine versus general anaesthesia were found to be effective for the said surgical procedure. 60 patients of CSDH were equally divided in 2 groups with computer generated randomization tables. Demographic characteristics and Glasgow Coma Scale (GCS) were comparable in both the groups. (Table 1)

Table 1. Demographic variables

		Group Dex	Group GA	P value
Age(years)(Mean ±SD)		44.37±13.46	42.53±17.09	0.646
Sex	**Male**	18 (60%)	19 (63.3%)	0.7
	Female	12 (40%)	11 (36.6%)	
ASA Grade 1/2/3		20/9/1	18/10/2	0.782
GCS (Mean±SD)		13.30± 0.99	13.30 ±0.95	1.00

ASA – American Society of Anesthesiologist, GCS= Glasgow Coma Scale.

In the Group D, mean dose of dexmedetomidine required was 101.8 ± 22.8 mcg and 12 patients of 30 (40%) required rescue propofol sedation with a mean dose of 25.8 ± 6.4 mg. We observed that there were no significant changes in mean anesthesia onset time and total duration of hospital stay in both groups. Mean time of total duration of surgery were also comparable (p = 0.848). However mean time to recovery from anesthesia was lower in Group D as compared to Group G (p<0.001). (Table2)

Table 2. Anaesthesia onset and recovery times

	Group Dex Mean± SD	Group GA Mean± SD	P value
Anaesthesia onset time (mins)	4.98±1.22	5.02±1.41	0.368
Total duration of surgery (mins)	44.40±9.88	44.90±10.29	0.848
Recovery time (mins)	12.67±3.14	18.40±5.04	<0.001
Total duration of hospital stays (days)	4.77±1.30	4.80±1.27	0.920

On analyzing the perioperative hemodynamic changes between the groups, we found that mean SBP, DBP and HR in Group G were statistically significantly more as compared to Group D at the time of induction, after 5 minutes of induction and at the time of extubation with the p value of SBP (0.040, 0.023, 0.010), DBP (0.012, 0.030, 0.020); HR (P=0.043, 0.018, 0.040) respectively (Figure 1-3). In Group D Respiratory rate (RR), EtCo2 and oxygen saturation did not change significantly from the baseline (RR; P = 0.758, EtCO2; P = 0.368, SPO2; p=0.739) (Figure 4).

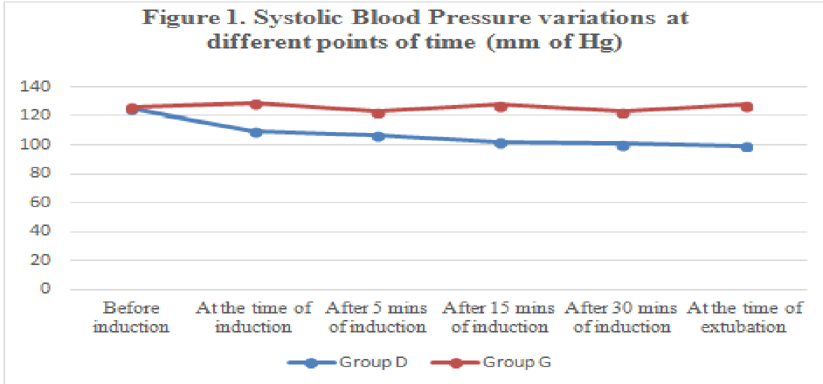


Figure 1. Systolic Blood Pressure variations at different points of time (mm of Hg)

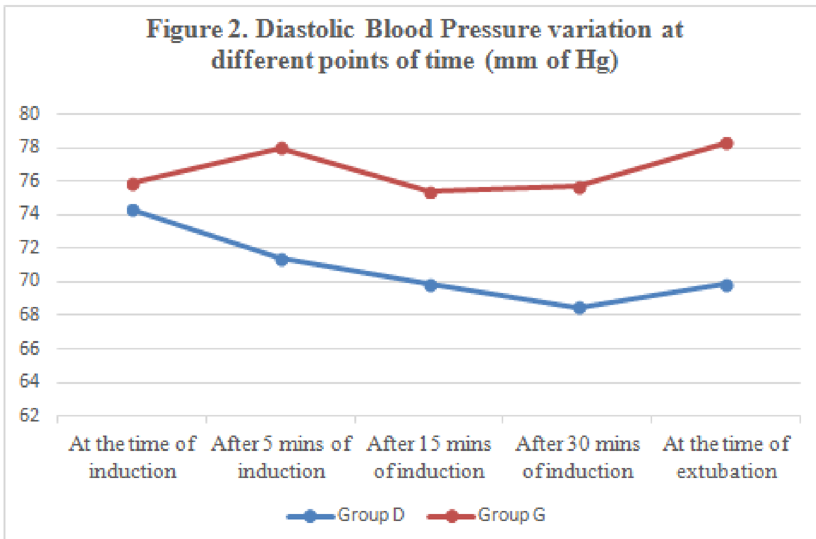


Figure 2. Diastolic Blood Pressure variation at different points of time (mm of Hg)

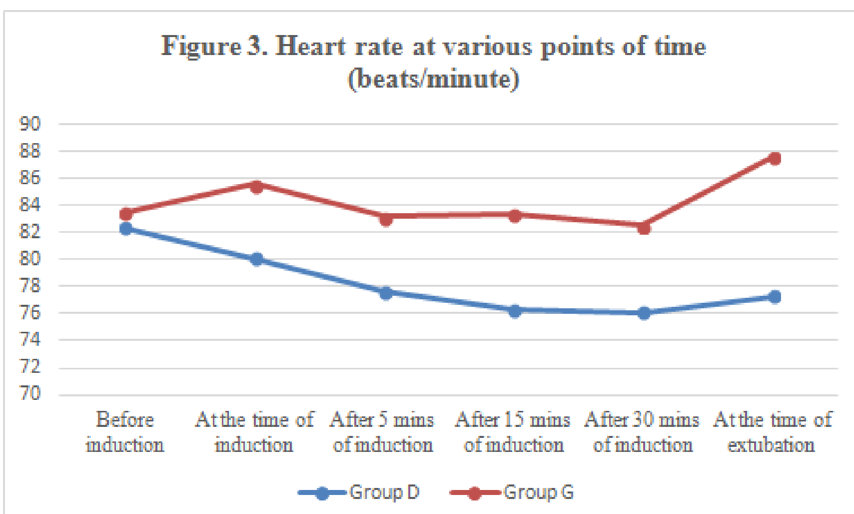
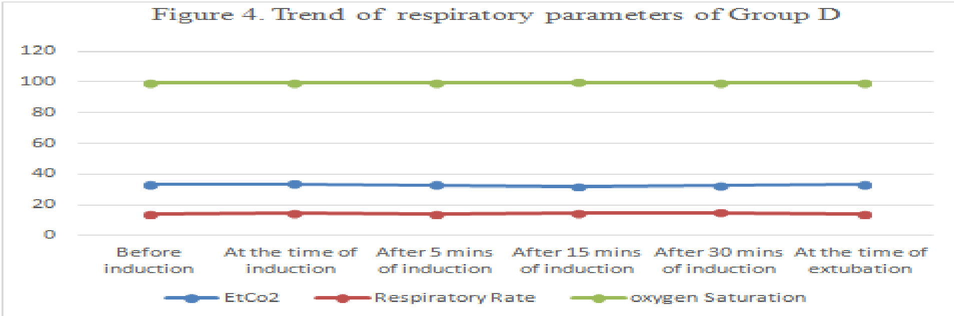


Figure 3. Heart rate at various points of time (beats/minute)



Overall postoperative complications, were significantly more in the Group G as compared with Group D (12 vs. 4 patients, p value = 0.041). (Table 4) Three patients (1 in Group D and 2 in Group G) had intraoperative hypotension which responded to fluid administration and IV ephedrine 6 mg bolus. Postinduction, mild skin rash was noted in 1 patient in the Group G, which responded to IV hydrocortisone. In Group D, 1 patient had oozing from the dural site, after the evacuation of the hematoma. The same patient had bradycardia (HR 40 to 45/min) with intermittent transient tachycardia (HR 120 to 140/min) lasting for 5 to 10 second and occasional ventricular ectopic at the time of cold saline wash. However, it subsided without any intervention and patient was hemodynamically stable.

Table 3. Post operative complications

Post-operative complications	Group D		Group G	
	No.	%	No.	%
Difficulty in breathing	1	3.33	1	3.33
Drowsiness	2	6.67	1	3.33
Restlessness and agitated	0	0.00	1	3.33
Snoring	1	3.33	2	6.67
Sore throat	0	0.00	2	6.67
Stridor	0	0.00	2	6.67
Severe hypertension with tachycardia	0	0.00	2	6.67
Desaturation with Bradycardia	0	0.00	1	3.33
Total no. of patients with any complication	4	13.33	12	40.00
P value	0.041			

Discussion

Chronic subdural hematoma is a common neurosurgical problem in old age. Since most of these patients are in geriatric group; the least invasive technique is preferred. Burr hole craniotomy is considered the gold standard for surgical treatment of chronic subdural hematoma[2]. Our aim is to minimize the surgical manipulations, anesthetic interventions and to enhance recovery with minimal complications.In general, for patients who have coexisting complex systemic disease, local anesthesia is a preferred method during surgery for CSDH[10]. Many reports from different studies noted the safety of both general and local anesthesia in chronic subdural hematoma with minor complications[3,4]. Moreover, general anesthesia may alter the return to preoperative levels of consciousness after such procedures which need to be evaluated early postoperatively to exclude the need for redo due to early postoperative recollection[5].Monitored anesthesia care has been widely used in many clinical fields such as gastrointestinal endoscopy, septoplasty, tympanoplasty, interventional or radiological procedures, cataract surgery, and awake bronchoscopy intubation. It can provide suitable intraoperative conditions for both patients and surgeons alike while avoiding the adverse reactions of general anaesthesia, e.g., hemodynamic instability and prolonged emergence. Furthermore, the related hospitalization time and cost of medical expenses are both decreased compared to surgery under general anaesthesia.

We observed that there were no significant changes in mean anesthesia onset time and total duration of hospital stay in both groups. Mean time of total duration of surgery were also comparable (p = 0.848). However mean time to recovery from anesthesia was lower in Group D as compared to Group G (p<0.001). This may be attributed to extra time taken for reversal of neuromuscular blockade and extubation as well as recovery from effect of volatile agents in the Group G. Rohini M. Surve et al[11] studied Significantly less time for recovery from anaesthesia (7.4±5.9 vs. 13.2±6.5 min, P=0.004) in the Dexmedetomidine group compared with general anaesthesia group. However, they observed that time to onset of anaesthesia (14.2±4.2 vs. 20.59±3.4 min, P=0.001) and total duration of surgery (77.1±23.9 vs. 102.7± 24.8 min, P=0.001) were also longer in the general anaesthesia group. Their patients received more dose of dexmedetomidine 1 mcg/kg over 10 min followed by maintenance infusion 0.5 mcg/kg/h in comparison of our patients. A study by Vinod Bishnoi et al[12] also favoured in faster postoperative recovery (mean± SD, 7.00± 6.96 vs. 13.69± 6.18 min, P= 0.000) with dexmedetomidine (1 mcg/kg over 10 minutes followed by continuous infusion 0.03 to 0.07 mcg/kg/h) during Burr-Hole Surgery for Chronic Subdural Hematoma.

On analyzing the perioperative hemodynamic changes between the groups, changes in the SBP, DBP and HR were significantly more in the Group G as compared with Group D. In the Group G, these haemodynamic variables were significantly more and fluctuating; probably as a result of stress response to laryngoscopy, endotracheal intubation as well as extubation. Moreover, Dexmedetomidine also maintains hemodynamic stability during the surgical procedures by modulating the release of catecholamines from central and autonomic nervous systems[10,13]. In a study by Wei Wu et[14], dexmedetomidine significantly lowers the haemodynamic parameters even after using low dose of drug (intravenously 0.3 mg/kg bolus followed by 0.2–0.3 mg/kg per h continuous infusion). It was due to net effect of α2-adrenoreceptor action which significantly reduce the circulating catecholamines, modest reduction in blood pressure, and modest reduction in heart rate[15,16]. In previous studies with higher doses (1 µg/kg) of dexmedetomidine patients got suddenly hypotension so we used low dose (0.7 µg/kg) of dexmedetomidine[8,17].According to Jon P. Belleville et al [18] and Eike Martin et al[17] Dexmedetomidine have no or minimal effect on respiratory rate and oxygen saturation. In our study respiratory rate, $EtCO_2$ and oxygen saturation did not change significantly from the baseline with dexmedetomidine (Figure 4). This denotes that dexmedetomidine was not associated with respiratory depression. Dexmedetomidine binds to a2 receptors rather than gamma-aminobutyric acid (GABA) receptors, so patients can be easily aroused from sedation and experience less significant respiratory depression[19,20]. Even in some studies oxygen saturation was significantly higher in the dexmedetomidine group. They explained about it that adequate sedation and analgesia without respiratory depression reduces the oxygen requirement and stable hemodynamic, which increases the cardiac output and thus oxygen supply[7-9,11,14].Overall postoperative complications were more in the Group G as compared with Group D (12 vs. 4 patients, p value = 0.041) (Table 3). The occurrence of stridor and sore throat in GA group may be because of endotracheal tube causing laryngeal irritation and persistent pressure respectively. Most of the postoperative complications were managed in the recovery room averting intensive care unit admissions. However, all the patients improved later and were discharged. In this study no patient experienced clinically significant bradycardia, and there were no cases of rebound hypertension or tachycardia after discontinuation of dexmedetomidine. Guzel A et al[21] found in their study that conscious sedation using monitored anaesthesia care, that is a middle ground between general anaesthesia and local anaesthesia, may facilitate patient comfort and surgical competence during surgery for CSDH.In Group D, surgical procedure was carried out successfully in 28 of 30 patients. 2 patients were excluded, as 1 patient did not cooperate despite the maximum dose of sedatives, GA (laryngeal mask airway) was provided and in 1 patient due to airway obstruction and fall in saturation; general anaesthesia (endotracheal intubation) was provided. No relevant history given by first patient; further study must be needed. In Group D 12 patients of 30 (40%) required rescue propofol sedation with a mean dose of 25.8 ± 6.4 mg which could have altered our results and this is a limitation of our study.

Conclusions

We found that the use of monitored anaesthesia care with Dexmedetomidine was effective modality for surgical evacuation of chronic subdural hematoma via burr hole craniotomy. It was associated with lesser complications and better haemodynamic stability without respiratory depression as compared to general anaesthesia.

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