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Evaluation of Dexmedetomidine infusion during middle ear surgery under general anaesthesia to deliver oligaemic surgical field

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Abstract

The present study was deliberate to evaluate the effects of dexmedetomidine infusion on the requisite of isoflurane concentration to lower systolic blood pressure below 30% of baseline values, quality of oligaemic surgical field, and awakening time in patients undergoing middle ear surgery.

The age of the patients is from 20-50 years. The surgery time ranges from 1 to 2 hours. The base line in both groups is observed in same range. After induction heart rates is observed in Group I as 65-81 beats per min and in group II as 64-82 beats per mins. After Extubation is observed slightly higher side on both groups. The Isoflurane required is more in group II to reduce the systolic blood pressure. In group I patients 18 cases showed minimum bleeding where as in group II 7 patients had found. In group I patients 3 cases are seen with diffuse bleeding and in group II 15 cases are found.

Dexmedetomidine infusion was harmless to deliver reduction haemorrhage for worthy surgical field and improved imagining for middle ear micro surgery keeping the haemodynamic differences within the physiological range. It also condensed the prerequisite of isoflurane and retrieval from anaesthesia was complete and smooth.

Keywords: Dexmedetomidine, middle ear microsurgery

Introduction

A stapedectomy is ear surgery that can be done to treat hearing loss caused by a problem called otosclerosis. Otosclerosis causes a build up of bone around the stapes (stirrup bone). The build up of bone keeps the stapes from moving normally, resulting in a type of hearing loss called conductive hearing loss [1]. A cholesteatoma is an abnormal, noncancerous skin growth that can develop in the middle section of your ear, behind the eardrum. Besides repeated infections, a cholesteatoma may also be caused by a poorly functioning Eustachian tube, which is the tube that leads from the back of the nose to the middle of the ear [2].

Although surgery is rarely urgent, once a cholesteatoma is found, surgical treatment is the only choice. Surgery usually involves a mastoidectomy to remove the disease from the bone, and tympanoplasty to repair the eardrum. The exact type of operation is determined by the stage of the disease at the time of surgery. For many years and still today, surgical treatment has provided successful treatment of chronic otitis media to control infection and prevent serious complications. Advancements of surgical techniques have now made it possible to rebuild the diseased hearing mechanism in most cases allowing improved hearing. The eardrum may need to be replaced and various tissue grafts may be used to replace it. These include the covering of the muscle from above the ear (fascia) and covering of ear cartilage (perichondruim), or covering from the skull (pericranium). A diseased ear bone may be replaced by an artificial part, a piece of cartilage, or even one of the original hearing bones. A thin piece of plastic (silastic) frequently is used behind the eardrum to prevent scar tissue from forming and to promote normal function of the middle ear and motion of the ear drum.

When the ear is filled with scar tissue or when all ear bones have been destroyed it may be necessary to perform the operation in two stages. During the first stage of surgery a piece of stiff plastic is inserted to allow more normal hearing without scar tissue. At the second surgery the plastic may be removed. During the operation the area will be examined for recurrent or residual disease and an attempt for restoring hearing is performed. A decision in regards to staging the operation in to two surgeries will be made during the time of the first surgery and is dependent on the findings [3].

Dexmedetomidine is an anxiety reducing, sedative, and pain medication. Dexmedetomidine is notable for its ability to provide sedation without risk of respiratory depression (unlike other commonly used sedatives such as propofol, fentanyl, and midazolam) and can provide cooperative or semi-arousable sedation. Similar to clonidine, it is an agonist of α2-adrenergic receptors in certain parts of the brain [4]. Intravenous infusion of dexmedetomidine is commonly initiated with a loading dose followed by a maintenance infusion. There may be great individual variability in the hemodynamic effects (especially on heart rate and blood pressure), as well as the sedative effects of this drug. For this reason, the dose must be carefully adjusted to achieve the desired clinical effect [5].

The current eventual study was planned to assess the effects of dexmedetomidine infusion on the requisite of isoflurane concentration to lower systolic blood pressure below 30% of baseline values, quality of oligaemic surgical field, and awakening time in patients undergoing middle ear surgery.

Methodology

The study is conducted in Lord Buddha Koshi Medical College and Hospital in Surgery department, From Nov 2014 to Dec 2015. The approval of ethical committee had been taken along

with the consent from the patients were also taken. Total 50 patients having are group of 20-60 year were enrolled in to the study. The patients undergoing to elective middle ear micro surgery were considered for the study.
Inclusion Criteria: elective middle ear micro surgery, were enrolled

Exclusion Criteria

- Patients having cardiac diseases,
- Patients having respiratory diseases,
- Patients having hepatic or renal disease,
- Patients on allergic to anaesthetic medications

Patients were divided in 2 groups.
Group I Patients: received infusion of dexmedetomidine 0.5 µg/kg/h
Group II Patients: received placebo infusion of normal saline during middle ear surgery after induction of anaesthesia till 20 min before completion of surgery
On arrival to the operation theatre, the baseline systemic blood pressure, heart rate, oxygen saturation (SpO2) and ECG were recorded. After establishing the intravenous line, lactate Ringer solution was started and they were premedicated with ondansetron (4µg), glycopyrrolate (0.2 mg), midazolam (2 mg) and fentanyl (2 µg/kg), 15 min before induction of anaesthesia. After pre-oxygenation for 3 min, anaesthesia was induced with propofol (2 mg/kg) till loss of verbal command and tracheal intubation was facilitated with Sch (2mg/kg). Anaesthesia was maintained with 60% nitrous oxide in oxygen with is of lurone and vecuronium (0.1 mg/kg) as muscle relevant. Patients were mechanically ventilated to maintain the end-tidal concentration (EtCO2) between 30 and 35 mm Hg.
Intra-operatively, the heart rate, non invasive blood pressure, ECG, EtCO2 and oxygen saturation (SpO2) were monitored and recorded at 5 min intervals till end of surgery. Concentration of isoflurane was recorded in percentage every 15 min till conclusion of surgery. Hypotension was treated by decreasing the dial concentration of isoflurane or rate of infusion and bradycardia was treated with intravenous atropine. During procedure the bleeding at surgical site was assessed by the surgeon as Grade 0-no bleeding excellent surgical conditions; Grade I-minimum bleeding, sporadic suction needed; Grade II-diffuse bleeding, repeated suction needed; and Grade III-considerable, troublesome bleeding, and continuous suction was needed.

Results & Discussion

The data from the both the study group patients were collected and presented as below.

Table 1: General Information

Group	Group I	Group II
Number of Patients	25	25
Age in years	22-38	25-42
Weight in kg	45- 73	43-75
Males	18	15
Females	7	10
Surgical time in mins	65 – 125	83 – 125

The age of the patients is from 20-50 years. The surgery time ranges from 1 to 2 hours. The base line in both groups is observed in same range. After induction heart rates is observed in Group I as 65-81 beats per min and in group II as 64-82 beats per mins. After Extubation is observed slightly higher side on both groups. The Isoflurane required is more in group II to reduce the systolic blood pressure. In group I patients 18 cases showed minimum bleeding where as in group II 7 patients had found. In group I patients 3 cases are seen with diffuse bleeding and in group II 15 cases are found.

Table 2: Heart Rate during Surgery

Heart rate Beats/min	Group I	Group II
Base line	83- 106	83-103
After induction	65-81	64-82
After intubation		
5 min	69-87	66-76
30 min	63-84	67-90
60 min	58-71	79-93
After Extubation	74-96	86-106

Table 3: Isoflurane Required to reduce the systolic blood pressure

	Group I	Group II
Isoflurane Percentage	0.3-1.3	0.9-2.1

Table 4: Intra-operative bleeding

	Group I	Group II
No bleeding	0	0
Minimum bleeding	18	07
Diffuse bleeding	3	15
Trouble bleeding	0	3

In the study of Bekker *et al.*, patients received an initial loading dose of 1 µg/kg of dexmedetomidine over 10 min, followed by a continuous infusion of 0.5 µg/kg/h and they determined that intra-operative dexmedetomidine infusion was effective for blunting the perioperative haemodynamic responses with no incidence of hypotension or bradycardia [6]. In a study by Kumkum *et al.*, dexmedetomidine infusion was safe to provide oligaemic surgical field for better visualization under operating microscope for middle ear surgery keeping the hemodynamic variations within the physiological range [7]. Our present study was in accordance with their study as all patients were haemodynamically stable, and none of them required vasopressor support or bolus administration of fluid to maintain haemodynamic status.
The result of the present study indicates that the use of dexmedetomidine infusion reduced the percentage of isoflurane concentration to maintain a systolic blood pressure 30% below baseline values. These findings confirm with a previous study of Khan *et al.* which also showed that use of dexmedetomidine reduces the requirement of inhalational anesthetic [8]. Aho *et al.* [9] and Aantaa *et al.* [10] also reported a reduction of isoflurane requirement in their study, thus confirm the synergism between isoflurane and dexmedetomidine.
Dexmedetomidine was well tolerated, and none of the patients developed any drug-related side-effectsor complications in the perioperative period. The dexmedetomidine infusion did not affect the awakening time or delay the recovery from anaesthesia.
Coughing on the tracheal tube during awakening will increase venous pressure and may cause postoperative bleeding, so deep extubation with smooth recovery is preferable. Guler *et al.* found that the increase in blood pressure and heart rate during extubation is decreased, and the quality of extubation is

improved by dexmedetomidine [11]. The current study is in line with the their study.

Conclusion

Dexmedetomidine infusion was harmless to deliver reduction haemorrhage for worthy surgical field and improved imagining for middle ear micro surgery keeping the haemodynamic differences within the physiological range. It also condensed the prerequisite of isoflurane and retrieval from anaesthesia was complete and smooth.

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