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Sedation is more Efficient than General Anesthesia for Stapes Surgery: A Single Center Experience

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Abstract

Background: Otosclerosis results in hearing loss caused by bony disease of the otic capsule. Treatment involves extremely delicate microsurgery: stapedectomy. Traditionally, stapes surgery was performed using general anesthesia to minimize patient movement. Recently, there has been an interest in intraoperative patient feedback regarding vestibular disturbances and hearing testing. There are no studies clarifying the optimal sedation protocol for these procedures.

Methods: We undertook a retrospective chart review (n=52) and assessed differences in patient tolerance of the procedure, length of surgery, estimated blood loss, hemodynamic instability, and post-operative pain and/or nausea between patients who underwent general anaesthesia and those who underwent dexmedetomidine based sedation with local anaesthetic (LoMAC).

Results: In addition to confirming that MAC using dexmedetomidine and local anesthetics is safe and well tolerated, thus allowing immediate perioperative neuro-otological feedback to the surgeon, our data also demonstrate a significantly shorter average length of surgery with MAC. Furthermore, we did not find differences regarding hemodynamic instability or post-operative pain medication requirements.

Conclusion: Since cost of procedures is directly related to OR time, there may be financial benefit with MAC.

Keywords: Anesthesia; Local; Dexmedetomidine; Efficiency, Organizational; Stapes

Introduction

Otosclerosis is a genetically mediated condition that is autosomal-dominant with variable penetrance and expression. Resultant hearing loss relates to diseased bones in the otic capsule and spongification and fixation of the stapes [1]. Clinically, otosclerosis presents as progressive, often bilateral, hearing loss that can be either purely conductive or both conductive and sensorineural depending on the location of bony disease. The hearing loss usually begins in the second or third decade of life, and presentation can be accelerated by pregnancy. Histopathology reveals sheets of connective tissue which replace bone after it is absorbed by osteoclastic activity and after new bone is deposited by osteocytes. This leads to a modification of the bone architecture, with increased numbers of osteocytes with enlarged marrow spaces full of blood vessels and connective tissue. As the disease advances, the lesions spread across the stapedial annular ligament, causing stapedial fixation.

Surgical treatment of otosclerosis has undergone significant evolution. Initially, stapes mobilization resulted in only short term hearing gain and risk of fatal labyrinthitis which understandably limited work on mobilization procedures [2]. In the early 1900s fenestration was developed which allowed sound to bypass a fixed stapes. The current era of stapes surgery can be traced to the 1950s when the use of prostheses and foot plate resection were incorporated into surgical techniques. Currently, the fenestration is created using either a micro drill or a laser [3], and a prosthesis is placed inside the hole. The prosthesis re-establishes continuity between the long process of the incus to the stapes footplate, restoring mobility.

Traditionally, all stapes surgery was performed using general anesthesia to minimize movement, thereby decreasing the challenges of this particularly delicate microsurgery. It also provided a controlled learning environment for residents and was thought to be most comfortable for patients [4]. Recently, surgeons have identified that intraoperative feedback about vestibular disturbances and hearing testing is highly valuable in optimizing outcomes [5].To do this, however, requires a patient who can relay information to the surgeon immediately, making general anesthesia unwarranted. For this reason, the culture of stapes surgery is shifting toward desiring comfortable, but only mildly to moderately sedated patients. Despite this consensus, there is a paucity of study of the feasibility of the technique and experience at specific centres [5-7]. Few personal experiences have been shared, [8-10] but no formal comparisons have been drawn between the use of local anesthesia/sedation and general anesthesia in those studies [11].While the advantages presented above seem obvious, there is also very little knowledge about simple intra- and post-operative outcomes of patients undergoing stapedectomy with general *vs.* local anesthesia.

The goal of this study, therefore, is to better understand the intra- and immediate post-operative differences between outcomes in stapedectomy using local anesthesia with moderate sedation and general anesthesia. We hope to better inform both the anesthesiology and otolaryngological communities whose work will ultimately benefit patients undergoing stapes surgery.

Methods

We undertook a retrospective chart review of all stapedectomy cases performed between September 2009 and January 2014 by a single surgeon (BC) at our academic medical center (n=52). A proposal for this patient-deidentified retrospective chart assessment was reviewed by the Research Study Review Board at the University of Rochester Medical Center and was given a "minimal risk" status waiver, conforming to ethical standards. All patients received between 5-8 ml of 1% Lidocaine with 1:100,000 epinephrine at the incision site at the outset of the procedure. Patients then underwent monitored anesthesia care (MAC) or general anesthesia. MAC was defined (for this procedure) as: loading the patient with 1 mcg/kg intravenous dexmedetomidine over 15-20 minutes and then administration of an infusion of 0.4 mcg/kg/hour with no additional adjuncts. General anesthesia (GA) involved typical intravenous induction, the use of an airway (LMA or ETT) and maintenance with a volatile agent, only, and not total intravenous anesthesia (TIVA). In the GA cases, additional intraoperative narcotics and anti-emetics were also given (or not) at the discretion of the anesthesia provider.

A total of 53 individual cases performed on 47 unique patients including cases for initial as well as revision stapedectomy were reviewed. Patients were between the ages of 20 and 84 at the time of surgery. Age and average weight were compared by two-sample T test and were determined to have no significant difference between groups. ASA classes were compared using Fisher's exact test and were also shown to have no significant difference similar between the two groups (Table 1).

Primary outcomes measured included the ability to tolerate MAC and cooperate with communication with the surgeon during the procedure (as documented in the operative report and/or the anaesthetic record) as well as the length of surgery (LOS, in minutes) from arrival of the patient to the operating room to arrival of the patient in the post anesthesia care unit (PACU). Secondary outcomes were the presence of hemodynamic instability (HDI) (defined as 20% variation of either heart-rate or blood pressure from baseline for more than 20% of the operative time), estimated blood lost (EBL, in ml), the need for post-operative narcotics (normalized to oral morphine equivalents), and the need for post-operative anitemetics (yes/no).

Results

Of our 53 cases, only one case (1.8%) which started under MAC necessitated conversion to general anesthesia for reasons of patient discomfort. Of the 25 cases performed under MAC, only four instances were noted where the patient was not able to communicate with the surgeon during the procedure (Table 2).

Average LOS was noted to be 56 minutes in the MAC group and 70 minutes in the general anesthesia group. When these values are compared using a two-sample t-test, the difference is statistically significant with p-value=0.02 (Table 3). Regression analysis to address possible confounding factors (age, weight) was also conducted, but only the type of anaesthetic was shown to have a statistically significant impact on the LOS (Table 4). This is a potentially significant finding as procedures performed in the operating room (OR) have costs that are directly related to the time spent and the resources used.

While a decrease in operating room time is clearly a benefit of MAC, this would certainly be overtaken by any significant peri or post-operative morbidity. To address perioperative concerns, we examined hemodynamic instability (HDI) differences during these cases. In the MAC group, 24% of cases demonstrated HDI, while HDI was present in 27% of the patients under general anesthesia (Table 5). Stapedectomy does not usually result in significant blood loss; however an inadequately anesthetized patient who moves creates the potential to increase this total exponentially. In our small study, estimated blood loss was also found to be similar between the two groups (Table 5).

Post-operative patient comfort was also assessed, as the drawbacks of poorly controlled pain or increased nausea or vomiting undermines the benefits of more efficient surgery. We examined whether cases done under MAC resulted in the need for increased post-operative narcotic or anti-nausea medications as compared with those done under general anesthesia. Patients who underwent the procedure with MAC, on average, used post-operative narcotics 36% of the time and post-operative anti-nausea medications 24% of the time. This was similar to patients who underwent general anesthesia and required narcotics 33% of the time and post operative anti-nausea medications 22% of the time (Table 6).

Patient Demographics							
	Dex			General			P-value (if applicable)
	N	Mean	Std Dev	N	Mean	Std Dev	
AGE (Yrs)	25	48.34	12.64	27	49.33	13.72	0.78
Weight (Kg)	25	76.35	19.07	27	84.82	22.84	0.15
ASA Class	**N**	**%**		**N**	**%**		
1	6	24		4	14.8		
2	17	68		20	74		
3	2	8		3	11		
Total	25			27			0.67

Table 1: Age and Weight: Two-sample t-test was used to compare the continuous variables between two groups. ASA Class: Fisher's exact test used to compare these two groups.

Ability of Patients to Cooperate			
	No	Yes	Total
MAC	4 (16%)	21(84%)	25
General Anesthesia	26 (96.3%)	1 (3.7%)	27

Table 2: Fisher's exact test shows highly significant difference between these two groups (p-value<0.0001)

Length of Surgery							
Variable	MAC			General Anesthesia			P-value
	N	Mean	Std Dev	N	Mean	Std Dev	
LOS (min)	25	56.04	19.29	26	70.04	21.92	0.02

Table 3: Two-sample t-test was used to compare the continuous variables between two groups. There is significant difference in the length of surgery (LOS)

Linear Regression Analysis								
Parameter		DF	Est	Std Error	Wald 95% Confidence Limits		Wald Chi-Square	P-value
Intercept		1	76.96	17.51	42.65	111.27	19.33	<.0001
Anesthetic	MAC	1	-15.32	5.60	-26.30	-4.35	7.49	0.01
Anesthetic	GA	0	0.00	0.00	0.00	0.00	.	.
AGE		1	0.20	0.21	-0.22	0.62	0.83	0.36
Weight		1	-0.20	0.13	-0.46	0.07	2.15	0.14

Table 4: Linear regression was used to study the effect of age, weight, and anesthetic on the length of surgery (LOS)

Perioperative Morbidity					
	MAC (n=25)		General Anesthesia (n=25)		P-value
	Mean	Std Dev	Mean	Std Dev	
EBL	5.48	13.74	5.68	10.46	0.95
Hemodynamic Instability	6 (24%)		7 (27%)		0.81

Table 5: Pearson's chi-square test shows no significant difference between these two groups for either variable

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Postoperative Narcotic Use	No	Yes
MAC	16 (64%)	9 (36%)
General Anesthesia	18 (67%)	9 (33%)
Postoperative Antiemetic Use	**No**	**Yes**
MAC	19 (76%)	6 (24%)
General Anesthesia	21 (78%)	6 (22%)

Table 6: Pearson's chi-square test shows no significant difference between these two groups for post operative narcotics (p-value=0.84) or post-operative anti-emetics (p-value=0.88)

Discussion

This small case series demonstrates a single center's comparison of stapedectomy performed under general versus local anesthesia/moderate sedation. Recent studies support the dearth of evidence comparing general to local anesthesia for this type of surgery [5].With novel, less invasive and less stimulating surgical techniques arising to treat otosclerosis, it is imperative that anesthesiologists adapt management plans accordingly.

The fact that only one of our cases required conversion from MAC to GA for reasons of patient comfort, suggests that MAC using dexmedetomidine is very well tolerated by patients undergoing stapedectomy at our center. This allows surgeons to gain immediate and important feedback from patients about the success of the surgical procedure in real time, such that adjustments and corrections can be made, if necessary.

Several options exist to effect adequate moderate sedation for audiological microsurgery including remifentanil [8], dexmedetomidine, and/or combinations of short acting narcotics and benzodiazepines [12]. When used in conjunction with general anesthesia, a comparison of remifentanil to dexmedetomidine for functional endoscopic sinus surgery favoured remifentanil for recovery times despite improved attainment of desired intraoperative hypotension [13]. Comparing monitored anesthesia care techniques of dexmedetomidine to that with midazolam plus tramadol patient controlled analgesia (PCA) for septoplasty or endoscopic sinus surgery, a recent study favored dexmedetomidine for analgesic effect and found no differences in recovery times or surgeon/anesthetist satisfaction [14]. Another recent prospective randomized double-blind study comparing dexmedetomidine to midazolam/fentanyl for tympanoplasty found comparable achievement of sedation with improved surgeon and patient satisfaction in the dexmedetomidine groupn [15].

While the use of remifentanil allows for rapid and controlled titration of analgesia with adequate maintenance of patient cooperation, it has also been associated with significant post-operative nausea and vomiting [12] in a patient population that is even more prone to this side effect due to having inner ear surgery. With this in mind, dexmedetomidine was chosen as the sole analgesic for sedation in our cohort and medications to prevent PONV were given prophylactically at the discretion of the anesthesia provider. Future studies should aim to prospectively compare these two anesthetic techniques, and collect clear outcome data including patient and surgeon satisfaction. In addition, cost benefit analysis could be applied to compare the techniques and operative/recovery time. Finally, objective hearing tests as a measure of surgical success should be studied during the anesthetic comparison.

Conclusion

Though our sample size is small, this review of our single center experience of using MAC with dexmedetomidine for sedation for stapes surgery underscores its safety and efficacy as an anaesthetic technique. With improved cooperation of patients, immediate hearing outcomes are also improved. In addition, our data also support shorter surgical times, even when accounting for age and weight, without additional intraoperative or postoperative patient discomfort that might prolong the PACU course. Since cost of procedures is directly related to time spent in the OR, decreasing this time offers a potential resource utilization and financial benefit.

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Declaration of Interest

The authors declare no financial interest in this study.

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References

1. Cummings CW (2005) Cummings otolaryngology head & neck surgery. 4th edition, Philadelphia, Pa: Elsevier Mosby.
2. Hausler R (2007) General history of stapedotomy. Adv Otorhinolaryngol 65: 1-5.
3. Lesinski SG, Stein JA (1989) CO2 laser stapedotomy. Laryngoscope 99: 20-24.
4. Derald E Brackmann M, Shelton C, Arriaga MA (2009) Otologic surgery Philadelphia: WB Saunders.
5. Wegner I, Bittermann AJN, Zinsmeester MM, van der Heijden GJM, Grolman W (2013) Local versus General Anesthesia in Stapes Surgery for Otosclerosis: A Systematic Review of the Evidence. Otolaryngol Head and Neck Surg 149: 360-365.
6. Lancer JM, Fisch U (1988) Local anesthesia for middle ear surgery. Clin Otolaryngol Allied Sci 13: 367-374.
7. Lavy JA, Powell HR (2013) Stapes surgery under local anesthesia. Ann R Coll Surg Engl 95: 37-39.
8. Edussuriya B, Goonasekera CD, Rajapakse M, Rajapakse VP, Jayasooriya D (1997) Middle ear surgery under local anesthesia and sedation. Ceylon Med J 42: 75-77.
9. Mesolella M, Lamarca S, Galli V, Ricciardiello F, Cavaliere M, et al. (2004) Use of Remifentanil for sedo-analgesia in stapedotomy: personal experience. Acta Otorhinolaryngol Ital 24: 315-320.
10. Caner G, Olgun L, Gultekin G, Aydar L (2005) Local anesthesia for middle ear surgery. Otolaryngol Head Neck Surg 133: 295-297.
11. Iannella G, Magliulo G (2016) Endoscopic verus microscopic approach in stapes surgery: Are operative times and learning curve important in making the choice? Otol Neurotol 37: 1350-1357.
12. Lee JJ, Lee JH (2011) Middle-ear surgery under sedation: comparison of midazolam alone or midazolam with remifentanil. J Laryng Otol 125: 561-566.
13. Karabayirli S, Ugur KS, Demircioglu RI, Muslu B, Usta B, et al. (2016) Surgical conditions during FESS; comparison of dexmedetomidine and remifentanil. Eur Arch Otorhinolaryngol.
14. Karaaslan K, Yilmaz F, Gulcu N, Colak C, Sereflican M, et al. (2007) Comparison of dexmedetomidine and midazolam for monitored anesthesia care with tramadol via patient-controlled analgesia in endoscopic nasal surgery: A prospective, randomized, double-blind, clinical study. Curr Ther Res Clin Exp 68: 69-81.
15. Parikh DA, Kolli SN, Karnik HS, Lele SS, Tendolkar BA (2013) A prospective randomized double-blind study comparing dexmedetomidine vs. combination of midazolam-fentanyl for tympanoplasty surgery under monitored anesthesia care. J Anaesthesiol Clin Pharmacol 29: 173-178.