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ORIGINAL ARTICLE

Anesthesiologist intervention during cataract surgery under topical or peribulbar anesthesia: a propensity model comparison

Marco Gemma[1], Luigi Gioia[1], Elisa Dedola[1], Benedetta Basta[1], Ingrid Bianchi[2], Francesco Fasce[2], Luigi Beretta[1]

[1]Anesthesia & Intensive Care Unit, San Raffaele Scientific Institute, Milano
[2]Ophthalmology Unit, Head and Neck Department, San Raffaele Scientific Institute, Milano - Italy

PURPOSE. *To compare the incidence and type of anesthesiologist intervention during cataract surgery under peribulbar (PA) or topical (TA) anesthesia in a day-surgery monitored anesthesia care setting (monitoring provided by nurses with the anesthesiologist available on an on-call basis).*
METHODS. *From a prospective database of all phacoemulsifications performed in our hospital (January 2008-January 2009), 97 patients submitted to cataract surgery under PA were matched with 97 patients submitted to the same surgery under TA by a propensity model. The resulting groups were homogeneous as to history of antihypertensive therapy administered on the day of surgery and not administered on the day of surgery, cardiologic history, neurologic history, psychiatric history, anxiolytic assumption, and history of diabetes mellitus. We compared the incidence of intervention of the anesthesiologist between groups and the type of adverse event triggering such interventions.*
RESULTS. *The anesthesiologist was called in 37 (38.14%) cases in the PA group and in 27 (27.84%) cases in the TA group (37 [38.14%]) (p=0.123). Only the occurrence of agitation differed significantly between groups (9 [9.28%] patients in the TA group vs 24 [24.74%] patients in the PA group; p=0.004).*
CONCLUSIONS. *Monitored anesthesia care is feasible for cataract surgery both under PA or TA. PA still remains an appealing alternative to TA during cataract surgery for patients incapable of keeping the operating eye in the primary position or with incoercible blinking, photophobia, or phacodonesis. A greater incidence of agitation is to be expected and adequate premedication with anxiolytics should be considered if PA is chosen. (Eur J Ophthalmol 2010; 20: 687-93)*

KEY WORDS. *Cataract, Monitored anesthesia care, Peribulbar anesthesia, Phacoemulsification, Propensity score, Topical anesthesia*

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INTRODUCTION

Cataract surgery is one of the most frequent surgical procedures on elderly patients in industrialized countries (1, 2). It was traditionally performed under peribulbar anesthesia (PA), but during the last 2 decades improvement in surgical techniques (3-13) boosted the use of topical anesthesia (TA) for cataract surgery.
Although some limitations of TA in comparison with PA have been described (14, 15), several works provided evidence that TA is a valid alternative to PA for cataract surgery (16-19). Adequate pain control, short recovery time, and good safety profile make TA an appealing technique for day-surgery phacoemulsification under monitored anesthesia care. In this setting, cost-effectiveness may be improved as perioperative monitoring is provided by nurses and the anesthesiologist is immediately available on an on-call basis (monitored anesthesia care).
We studied data from a prospectively collected database of patients submitted to cataract surgery under monitored

anesthesia care. We constructed a propensity model to compare the incidence of anesthesiologist call by the attending nurse between a group of patients submitted to PA and a matched group of patients submitted to TA. The type of adverse event triggering the anesthesiologist intervention was also studied.

METHODS

Clinical data of all consecutive patients submitted to phacoemulsification and intraocular lens (IOL) implantation under TA or PA at the San Raffaele Hospital of Milan from January 2008 to January 2009 were prospectively collected in a database for clinical purposes. The utilization of these data for scientific purposes was approved by our local Ethics Committee.

The database included 2005 patients submitted to TA and 97 patients submitted to PA. This reflects our current practice: we consider TA the standard anesthesia for cataract surgery and we administer PA only to patients incapable of keeping the operating eye in the primary position or with incoercible blinking, photophobia, or phacodonesis. We matched our 97 PA patients with an equal number of patients selected among the 2005 TA patients in the database. Case matching was retrospectively obtained with a propensity model. This incorporated 14 variables that were considered possibly relevant with respect to the need of anesthesiologist involvement during monitored anesthesia care (see Statistics section).

Outpatient evaluation was performed in all cases within 2 weeks before surgery by 1 of 2 senior internal medicine physicians. Clinical history was acquired and physical examination performed. Preoperative full blood count and coagulation tests were performed in all patients. Electrocardiography was performed if required on a clinical basis. Patients were advised to abstain from food and liquids 6 hours before surgery and to take all their usual preoperative medications on the day of surgery, except for insulin and oral hypoglycemic drugs (in these cases immediate preoperative glycemia was determined). Antiplatelet and anticoagulant therapy were not interrupted if TA was scheduled, but patients undergoing PA were asked to discontinue antiplatelets 5 days before surgery and anticoagulants 3 days before surgery (in this case low-molecular-weight heparin was initiated).

According to the outpatient preoperative evaluation, the ASA physical status score (20) was determined and the presence or absence of the following was assessed: history of antihypertensive therapy administered also on the day of surgery; history of antihypertensive therapy not administered on the day of surgery; cardiologic history (previous diagnosis of cardiac ischemic disease, arrhythmia, valvulopathy, cardiac failure); neurologic history (previous diagnosis of chronic cerebral ischemia, epilepsy, Parkinson disease, amyotrophic lateral sclerosis, multiple sclerosis, dementia, neuromyopathy, migraine); psychiatric history (previous diagnosis of major mood disorder, psychosis, neurosis); anxiolytic assumption; and history of diabetes mellitus (either type I or II).

Cataract surgery took place either in the morning (8 am-2 pm) or in the afternoon (2 pm-8 pm) and was performed by 1 of 2 senior ophthalmologists.

Patients were admitted on the day of surgery. Before entering the operative room, a nurse established an intravenous line, connected it to a 100-mL saline drip, and applied oxybuprocaine hydrochloride 0.4% and ciprofloxacin 0.3% to both eyes. Tropicamide 0.5% and phenylephrine 10% were applied to the operated eye. Povidone 10% iodine solution was used for primary disinfection of periorbital skin. Thereafter, anesthesia was provided in the operating room.

If PA was scheduled, it was administered according to our standard practice (21, 22). Mepivacaine 2% and hyaluronidase 1/10 (total volume 3-5 mL) were administered with a 5-mL syringe. The needle (Atkinson 25G 1.25”) was inserted inferotemporally and transcutaneously and the drugs were gently injected after aspiration to avoid risk of intravascular injection. Afterwards, ocular compression was applied for 3-5 minutes until a satisfactory anesthesia was achieved. No sedation/analgesia was provided for PA placement.

If TA was scheduled, lidocaine hydrochloride 4% was administered and povidone 5% iodine solution was instilled in the operating eye. No intracameral anesthesia was performed as part of the TA protocol.

Intraoperative monitoring was provided by senior registered nurses (monitored anesthesia care). Electrocardiography (lead II) and pulse oximetry were continuously measured by a Philips Anaesthesia V24C (Germany) monitoring device. Heart rate and noninvasive arterial blood pressure were recorded every 5 minutes.

An on-call anesthesiologist was immediately available and was called by the attending nurse if one or more of the following occurred: nonarterial hypertension: systolic blood

pressure >200 mmHg or diastolic blood pressure >110 mmHg; arterial hypotension: systolic blood pressure <100 mmHg; tachycardia: heart rate >120 beats per minute; bradycardia: heart rate <50 beats per minute; ECG alterations suggestive of arrhythmia, ischemia, or infarction; psychomotor agitation that could hamper surgery; bradypnea: respiratory rate <10 per minute; cough.

The need for anesthesiologist involvement as well as the administered treatment was documented. Length of surgery was recorded.

At the end of surgery, ciprofloxacin 0.3% and povidone 10% iodine solution were administered to the operated eye. After dressing, monitoring was interrupted and the intravenous line removed.

Patients waited for discharge in a recovery room where a nurse was constantly present and were then discharged according to medical advice 2-3 hours after the end of surgery.

STATISTICS

The database included 2005 patients submitted to TA and 97 patients submitted to PA.

In order to properly match patients submitted to PA with patients submitted to TA, a propensity model was constructed (23-25). Logistic regression analysis was run incorporating 14 variables: gender, age, body mass index, ASA status (1-2 vs 3-4), length of surgery, surgical session (morning vs afternoon), operated eye (first vs second), history of antihypertensive therapy assumed also on the day of surgery, history of antihypertensive therapy not assumed on the day of surgery, cardiologic history, neurologic history, psychiatric history, anxiolytic assumption, and history of diabetes mellitus. Nominal variables were expressed as dummy variables. The resulting coefficients were applied to each variable and to the intercept to calculate the propensity score of each case. For each patient in the PA group the patient with the nearest propensity score was selected among the TA patients.

After matching, the resulting TA and PA groups did not differ significantly in any of the 14 variables considered (see Tab. I).

Continuous variables are expressed as mean ± SD and compared with the paired data t test.

Nominal variables are expressed as number (%) and compared with the McNemar test.

Statistical analyses were performed with dedicated software (Systat 12 version 12.02.00, Systat Software Inc., Chicago, IL, USA).

RESULTS

Although the anesthesiologist was called by the attending nurse more often for patients in the PA group than in the

TABLE I - VARIABLES USED FOR THE CONSTRUCTION OF THE PROPENSITY MODEL

	Topical anesthesia	Peribulbar anesthesia	p
Age, y	66.5±12.5	68.0±15.0	0.500
Body mass index	25.49±14.14	25.43±3.87	0.886
Length of surgery, min	18.0±8.5	19.0±10.5	0.886
Male	49 (50.52)	55 (56.70)	0.396
ASA (1–2)	86 (88.66)	82 (84.54)	0.414
Surgical session (morning)	61 (62.89)	58 (59.79)	0.639
Operating eye (first)	57 (58.76)	57 (58.76)	1.000
Antihypertensive therapy assumed also on the day of surgery	43 (44.33)	44 (45.36)	0.886
Antihypertensive therapy not assumed on the day of surgery	12 (12.37)	10 (10.31)	0.637
Cardiologic history	17 (17.53)	24 (24.74)	0.223
Neurologic history	5 (5.16)	7 (7.22)	0.480
Psychiatric history	1 (1.03)	3 (3.09)	0.317
Anxiolytic assumption	6 (6.19)	5 (5.16)	0.763
History of diabetes mellitus	15 (15.46)	21 (21.65)	0.303

After matching, the 2 groups do not differ in any of the variables considered. Continuous variables are expressed as mean ± SD and compared with the paired data t test. Nominal variables are expressed as n (%) and compared with the McNemar test.

TA group (37 [38.14%] vs 27 [27.84%] cases, respectively), this difference was not significant (p=0.123).
Similarly, drug administration by the anesthesiologist was more frequent for patients in the PA group than in the TA group (36 [37.11%] vs 24 [24.74%] cases, respectively), although this difference was not significant (p=0.058).
Table II reports on the occurrence of adverse events triggering the anesthesiologist call by the attending nurse. Two events account for the majority of anesthesiologist calls; namely, agitation (10.31% of TA and 24.74% of PA patients) and arterial hypertension (15.46% of TA and 14.43% of PA patients). The incidence of agitation was significantly different between groups (p= 0.004). The incidence of the other categories of adverse event did not differ significantly between groups. Bradypnea never occurred in our patients. Hypotension (2 patients [2.06%]), cough (2 patients [2.06%]), and ECG alterations (1 patient [1.03%] occurred only in the PA group.
Table III reports on the occurrence of adverse events requiring drug administration by the anesthesiologist. Only the occurrence of agitation differed significantly between groups (9 [9.28%] patients in the TA group vs 24 [24.74%] patients in the PA group; p=0.004).
No life-threatening complications occurred in our patients and intraoperative complications never required the interruption of surgery.

DISCUSSION

Local (ocular injury, retrobulbar hemorrhage, posterior vitreous hypertension, extraocular muscle damage) and sys-

TABLE II - OCCURRENCE OF ADVERSE EVENTS PROMPTING THE ANESTHESIOLOGIST CALL BY THE ATTENDING NURSE

	Topical anesthesia		Peribulbar anesthesia		p
	No.	%	No.	%	
Agitation	10	10.31	24	24.74	0.004*
Hypertension	15	15.46	14	14.43	0.835
Hypotension	—	—	2	2.06	0.158
Bradycardia	1	1.03	1	1.03	1.000
Tachycardia	2	2.06	1	1.03	0.564
Bradypnea	—	—	—	—	—
ECG alteration	—	—	1	1.03	0.320
Cough	—	—	2	2.06	0.158
Anesthesiologist call	27	27.84	37	38.14	0.123

The single items do not sum up to the total number of anesthesiologist calls as more than one event could have prompted the anesthesiologist's intervention.
*p<0.05.

TABLE III - OCCURRENCE OF DRUG ADMINISTRATION BY THE ANESTHESIOLOGIST ACCORDING TO ADVERSE EVENTS

	Topicalanesthesia		Peribulbaranesthesia		p
	No.	%	No.	%	
Agitation	9	9.28	24	24.74	0.002*
Hypertension	15	15.46	14	14.43	0.835
Hypotension	—	—	2	2.06	0.158
Bradycardia	—	—	1	1.03	0.320
Tachycardia	1	1.03	—	—	0.320
Bradypnea	—	—	—	—	—
ECG alteration	—	—	—	—	—
Cough	—	—	2	2.06	0.158
Drug administration by the anesthesiologist	24	24.74	36	37.11	0.058

The single items do not sum up to the total number of anesthesiologist calls as more than one event could have triggered the anesthesiologist's intervention.
*p<0.05.

temic (anesthetic systemic toxicity, pain, agitation) complications have been described during PA anesthesia for cataract surgery (26, 27). In particular, a variable incidence (3.2%-54%) of intraoperative systemic adverse events during PA has been reported (16, 28-31).

The incidence of intraoperative systemic complications during cataract surgery under TA is similarly variable, but tends to be lower (2.9%-25.7%) (16, 32, 33). This contributed to the increasing popularity of TA for cataract surgery, together with the rapid postoperative recovery it warrants (34, 35) and the good level of analgesia it provides (3, 36). Nevertheless, cardiovascular instability and psychomotor agitation have been reported with TA (32, 37, 38) and in a previous randomized study patients significantly preferred PA over TA (14). Other studies that randomly compared PA and TA during cataract surgery reported a similar incidence of complications and suggest that TA may be preferable (17-19). A recent study (16) on 2020 patients found a significantly greater incidence of systemic complications in patients receiving PA.

In our hospital, monitored anesthesia care is routinely provided by trained nurses to patients undergoing cataract surgery. The anesthesiologist is immediately available on an on-call basis. Although there is no full agreement about this topic, several authors suggest the safety and efficacy of this strategy (28-29, 32, 39).

In our study, we compared the incidence of anesthesiologist intervention between a group of patients submitted to cataract surgery under PA and a paired group of patients submitted to the same type of surgery under TA. Matching of the patients was obtained by a propensity model (23-25). This model allowed homogeneity for a number of items that potentially affect the occurrence of intraoperative systemic complications. For example, the chance of occurrence of systemic complications may be greater as surgery is prolonged, the experience of previous cataract surgery may boost agitation, and elderly patients or patients with comorbidities may have more systemic complications. The latter item is particularly important since elderly patients and patients with comorbidities are the majority of cataract surgery patients (40) and their number is expected to grow (32).

It should be noted that patients undergoing PA anesthesia were selected according to our standard practice; namely, they were patients incapable of keeping the operating eye in the primary position or with incoercible blinking, photophobia, or phacodonesis. This patient selection cannot be corrected by the propensity model and could account for any difference we observed between groups. However, our study design allows a retrospective analysis of our series by eliminating several confounding variables.

Another limitation of our study, which is intrinsic to the propensity model method, is that the 2 groups may actually differ significantly in items we did not incorporate in the model.

The rate of anesthesiologist intervention was not different between groups, although a trend towards a higher rate in the PA group was apparent. This trend was more pronounced as only the anesthesiologist interventions leading to drug administration were considered. It is possible that our study was underpowered to detect this possible difference.

With respect to the type of complication that triggered the anesthesiologistís intervention, we found that agitation was significantly more frequent in the PA group, and this was more evident as only the agitation episodes requiring drug administration were considered. This feature is important since agitation was the most frequent adverse event in our patients and since it has a straightforward interpretation. In fact, it is conceivable that the invasive PA maneuver may generate anxiety and possibly pain without providing better analgesia than TA during surgery.

This result is in contrast with a previous work (15) that reports on a significantly greater need for additional sedation in patients under TA than in patients under PA, but patients in that study received routine fentanyl administration before surgery and it is possible that this may have reduced patient collaboration during surgery.

On the other hand, it is conceivable that our practice of administering no routine premedication before cataract surgery may have increased the occurrence of intraoperative agitation. Routine preoperative and intraoperative sedation is provided in many centers, but may actually increase the occurrence of systemic complications (30) and has been found not to improve operative conditions and outcome (15).

We reported both the global incidence of anesthesiologist interventions and the incidence of drug administration by the anesthesiologist. This issue may help in understanding the real severity of systemic adverse events during monitored anesthesia care. Unfortunately, it is underreported by previous works. Since drug administration occurred in the majority of the reported interventions, it is conceivable that the anesthesiologist calls by the attending nurses were correctly motivated.

Our data suggest that monitored anesthesia care is feasible for cataract surgery under PA or TA. PA remains an appealing alternative to TA during cataract surgery for patients incapable of keeping the operating eye in the primary position or with incoercible blinking, photophobia, or phacodonesis. A greater incidence of agitation is to be expected and adequate premedication with anxiolytics should be considered as PA is chosen.

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Address for correspondence:
Marco Gemma, MD
Anesthesia and Intensive Care Unit
San Raffaele Scientific Institute, Milano, Italy
Via Olgettina 60
Milano, 20132 Italy
gemma.marco@hsr.it

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