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Comparison of Balanced General and Total Intravenous Anaesthesia for Gasser Ganglion Percutaneous Balloon Microcompression for Trigeminal Neuralgia

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ABSTRACT

Objective: To compare the effectiveness between balanced general anaesthesia and total intravenous anaesthesia for the hemodynamic control of patients undergoing percutaneous balloon microcompression of the Gasser's ganglion in trigeminal neuralgia.

Patients and methods: A retrospective trial was conducted in thirty patients with the diagnosis of essential trigeminal neuralgia, aged 37 to 82 years old, ASA I and II. The participants were randomly allocated in two groups: Group A, to receive balanced general anaesthesia (BGA) with isoflurane/fentanyl, or Group B, to receive total intravenous anesthesia (TIVA) with propofol/remifentanil. The systolic, diastolic and mean arterial blood pressure, heart rate and oximetry were measured at basal state, entrance to Meckel's cavum and during the balloon compression. Statistical analysis with the Student T test for continuous quantitative variables and x2 (Chi square) for qualitative variables was performed.

Results: The systolic blood pressure was significantly higher in group A at the moment of greatest stimulation. The technique propofol/remifentanil (group B) obtained better hemodynamic control and its management was easier. The incidence of bradycardia was similar in both groups and kept inverse relation with use of previous atropine.

Conclusions: Total intravenous anesthesia (TIVA) is an attractive alternative to balanced general anesthesia due to the better hemodynamic response and the quick recovery that this technique offers. Moreover, Atropine use before the procedure is a measure that could benefit patients.

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Introduction

Percutaneous microcompression of the Gasserian ganglion using a Fogarty catheter-balloon is a therapeutic alternative for the trigeminal neuralgia. This technique was introduced by Mullan and Lichtor in 1983 [1]. In Chile it was performed for the first time in 1992 by Flores J. and Holzer J. MD at Dipreca Hospital.

Different authors have reported risings of blood pressure and heart rate changes and rhythm during the procedure; this results in an increase of cardiac metabolic demands; thus increasing the myocardial ischemia risks, mainly in the elderly patient or people with coronary heart disease, and of strokes. Due to these frequent hemodynamic alterations, it has been recommended a strict monitoring and even the use of an external pacemaker [2].

An ideal neuroanaesthesia technique would be the one that allows maintaining stable hemodynamics parameters at the intraoperative, associated to a fast emergence period so as to perform an early neurological evaluation. Different anaesthetic techniques to achieve this ideal exist in the literature. Up now, no paper describes the results of total intravenous anaesthesia with target-controlled infusion (TCI) system (TIVA-TCI) for these type of surgical procedures.

Remifentanyl is an opioid, with a unique pharmacodynamic and pharmacokinetic profile, of ultra-short action, fast onset and predictable fast wear off, all of which has allowed to attenuate the hemodynamic response to the surgical stimuli in diverse surgical procedures without delaying the time of awakening [3].

Propofol and remifentanil have been administrated together to provide anaesthesia for some time and the pharmacokinetics of each one is well known. Their coadministration produces a synergic interaction. The literature provides papers which have shown that remifentanil decreases the hemodynamic response to orotracheal intubation and that the administration of propofol with remifentanyl allows an intubation without the need of muscle relaxants [4,5].

Patients and Methods

The records of 121 patients who underwent a Fogarty balloon Gasser ganglion microcompression for treatment of essential trigeminal neuralgia at Hospital Dipreca (Santiago, Chile) were reviewed. Of these, those who were undergoing the procedure for the first time, who were in synus rhythm, were not receiving ß-blockers nor other antiarrhythmic drugs and were ASA (*American Society of Anesthesiologists* Class I or II. Exclusion criteria wereMorbid obese patients, defined by a BMI >30, were excluded, and those with history of drug dependence. Finally, 30 patients, of both sexes, and aged between 37 and 82 were selected by a consecutive case sampling.

At all cases systolic, diastolic and mean blood pressure, heart rate and oximetry were registered at the following procedure moments:

- Baseline: When the patient arrived to the operating room.
- At the moment of entering the foramen ovale with the needle.
- During the compression with the balloon.

A multiparameter monitor for vital signs was used in which allowed to take EKG and analysis of ST segment, non-invasive automatized measurement of blood pressure, oximetry and capnography.

At the arrival of the patients to the operating room, the anaesthesiologist installed peripheral vein cannula they were hydrated with Ringer lactate solution at a rate of 10 ml/kg. Antibiotic prophylaxis with cefazoline 1 or 2 g IV depends the weight of patient and preemptive analgesia with ketoprofen 100 mg IV was administered.

All patients with a heart rate equal or below 60 bpm pre or post anesthesia induction, received Atropine 0.3-0.6 mg IV

Patients had been randomly assigned in 2 groups:

- **Group A:** Former by 13 patients who received balanced general anaesthesia, whom induction was performed with a 2 µg/kg fentanyl and 1,5-2 mg/kg propofol dosage.
- **Grupo B:** Formed by 17 patients who received total intravenous anaesthesia with target-controlled infusion system (TIVA-TCI). They were induced with 0,25 µg/kg of remifentanil and y propofol administrated through the Zeneca Ltd© 's (from AstraZeneca©, Macclesfield, Cheshire, UK) TCI system "Diprifusor" (incorporated in the Master TCI® system from Becton-Dickinson©, Franklin Lakes, New Jersey), programmed to obtain a target plasmatic concentration of de 3 µg/ml.

Vecuronium 0,1 mg/kg was used in both groups in order to access orotraqueal intubation.

The maintenance was accomplished with:

- **Group A:** N2O/O2 at 50% + Isoflurane 1,5-2%.
- **Group B:** Propofol, administrated by the same TCI system programmed for a target concentration of 2 µg/ml + remifentanil 0,5 µg/kg/ min since the beginning of the surgery.

The patients of both groups were kept with intraoperative mechanic ventilation for keeping an end tidal CO2 of 30-35 mm Hg.

All surgical interventions were performed by the same surgical team, with the same technique and with similar balloon insufflating times. All patients were extubated at the operating room; neostigmine was used to reverse the muscle relaxant when it was necessary.

Regarding statistic analysis, mean values and standard deviations were used for the continuous quantitative variables and percentages for the qualitative variables. To compare the groups t Student tests for continuous quantitative variables and x^2 (Chi squared) for qualitative variables was used, respectively. The differences were considered statistically significant when $p<0,05$.

Results

30 patients, 11 males (37%) and 19 females (63%) were studied. Mean ages was 68 ± 6,5 years in group A and 70 ± 7,2 in group B.

The groups were comparable in age, ASA class, compression time of Gasser ganglion and surgery. The baseline values of blood pressure were similar in both groups: (Table 1).

Table 1: Comparison of both groups according to the different parameters measured at basal state

Variables	Group A (n=13)	Group B (n=17)
Females/Males	9/3	10/8
ASA I/II	2/11	3/14
Age (years)	68 ± 6,5	70 ± 7,2
Weight (kg)	69 ± 8,0	72 ± 6,3
Height (cm)	158 ± 3	162 ± 2
BMI	27 ± 3	27,4 ± 3
Systolic BP	142 ± 5,6	146 ± 5,8
Diastolic BP	78 ± 12,6	76 ± 10,8
Heart Rate	82,4 ± 13,1	81,3 ± 14,5
Sat. O_2	95,8 ± 2	96,1 ± 1,8

When analyzing the hemodynamic changes , we can appreciate that during the entry to the foramen ovale there is a rise of the systolic blood pressure which reaches an average of 180 mmHg in group A and 160 mmHg in group B. Likewise, the average diastolic pressures were 96 and 94 mmHg, respectively.

During Gasser ganglion ballon compression a global increase of the systolic, diastolic and mean blood pressures was observed in 86% of the patients (84% in group A and 88% in group B). At this stage, the systolic pressures reached an average of 205 mmHg in group A and 160 mmHg in group B. It is clear the statistically significant difference between both groups. ($p <0.05$) Something similar happened with the diastolic pressures, which average numbers were 125 mmHg and 100 mmHg respectively (Table 2).

Table 2: Comparison of both groups regarding blood pressure at different surgery moments

BP at different surgery moments	Group A (n = 13)	Group A (n = 13)
Systolic BP at the beginning of the surgery	100,6 ± 13,2	103,9 ± 15,6
Diastolic BP at the beginning of the surgery	59,6 ± 9,4	62,1 ± 9,8
Systolic BP at entering the foramen ovale	180 ± 15,8	160 ± 17,4
Diastolic BP at entering the foramen ovale	96 ± 18,3	94 ± 18,7
Systolic BP during the compression	205 ± 19,6	160 ± 16,9
Diastolic BP during the compression	125 ± 17,8	100 ± 17,5

If we define hypertensive crisis as an arterial blood pressure rise of greater than a 20% from the basal value and that in order to control, it it's required the use of hypotensive drugs, it was found that during the compression with balloon, this crisis was presented in the 54% of group A's patients and only in the 12% of group B. Clearly there is a statistically significative difference. ($p< 0.05$) (Table 3).

Table 3. Hypertensive crisis incidence

Type of anaesthesia	n	%
Balanced general	7/13	54
TIVA-TCI	2/17	12

Severe bradycardia (defined as a decrease of the heart rate below 40 beats per minute) and/or asystole had a global incidence of 20%, with 3 patients in each group. It was present only in those cases where Atropine was not used previous to the procedure and at the moment of entering the foramen ovale. (Table 4).

Table 4: Bradycardia and/or asystole incidence

Use of atropine	Balanced general anaesthesia	TIVA-TCI
YES	0/10	0/14
NO	3/3	3/3

Discussion

When looking at the existent literature we found studies that compare the hemodynamic effectiveness of different balanced general anaesthesia schemes with the ones of total intravenous anaesthesia in different surgical procedures, but none of them during de Gasserian ganglion microcompression in trigeminal neuralgia [6]. Moreover, none of the reviewed studies has been conclusive to determine if total intravenous anaesthesia (TIVA) offers a better hemodynamic stability than balanced general anaesthesia.

On the other hand, there are reports of the abrupt hemodynamic changes that present in patients who are subjected to the Gasserian ganglion balloon microcompression [2,7,8] In our study we also found the same hemodynamic disturbances.

Because of it, our hypothesis was that total intravenous anaesthesia may provide a better cardiovascular stability than balanced general anaesthesia for patients undergoing a percutaneous balloon microcompression of the Gasserian ganglion in trigeminal neuralgia.

Beers y Dershwitz showed in their studies that remifentanyl suppresses effective and quickly the hyperdynamic response to stimuli [9,10]. The results of our study agree with theirs, since with the propofol/remifentanil scheme a better hemodynamic control was achieved than with balanced general anesthesia during the mayor surgical stimulation period, and also it did not delay de recovery time.

The fact that the propofol/remifentanyl technique better attenuates the hypertensive response could be due their pharmacokynetic characteristics of each drug and its synergism. Mertens et al demonstrated that propofol reduces remifentanyl requirements to soften the hemodynamic response to the laryngoscopy, intubation and surgical stimuli in abdominal surgery [11]. In the present study our findings were similar : when comparing both study groups we found a stadistic significant difference relative to the magnitude of the hemodynamic change was found, for the hypertensive response was much higher in the group who received balanced general anaesthesia.

In regard to the heart rate, we could notice that the use atropine previous to the procedure abolished the appearance of severe bradycardia and/or asystole.

Conclusion

The intraoperative hemodynamic behavior of the patients undergoing a Gasserian ganglion balloon microcompression is more stable with the total intravenous anaesthesia technique (TIVA). Moreover, it allows a fast emergence thus easing early neurologic evaluation and shorter times of permanence at the recovery unit (PACU). Therefore, this anesthesic technique is an attractive alternative to balanced general anaesthesia.

Then again, Atropine use previous is a procedure that may benefit the patients.

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