Curative ablation of atrial fibrillation: comparison between deep sedation and general anesthesia

Ablação curativa da fibrilação atrial: comparação entre sedação profunda e anestesia geral

Elizabeth Bessadas Penna Firme[1]; Ismar Lima Cavalcanti[2]; Louis Barrucand[3]; Alexandra RezendeAssad[4]; Nubia Verçosa Figueiredo[5]

A B S T R A C T

Objective: To compare deep sedation with general anesthesia for curative ablation of atrial fibrillation. **Methods**: We conducted a prospective, randomized study with 32 patients, aged between 18 and 65 years, ASA 2 and 3, BMI d" 30kg/m2, divided into two groups: deep sedation (G1) and general anesthesia (G2). All patients received intravenous midazolam (0.5 mg / kg). G1 received propofol (1mg/kg) and O_2 by facemask, followed by continuous infusion of propofol (25-50mg/kg/min) and remifentanil (0.01-0.05 mg / kg / min). G2 received propofol (2mg/kg) and laryngeal mask with built-in drain tube, followed by continuous infusion of propofol (60-100mg/kg/min) and remifentanil (0.06 to 0.1g/kg/min). We compared heart rate, invasive blood pressure, arterial blood gases, complications and recurrence (outcome) in three months. **Results**: G1 patients had arterial blood gas with higher $PaCO_2$ levels and lower pH (p = 0.001) and higher incidence of cough. There was a decrease in Mean Arterial Pressure (MAP) and Heart Rate (HR) in G2. Except cough, complications and recurrence were similar in both groups. **Conclusion**: Both techniques can be used for the curative ablation of atrial fibrillation. General anesthesia provided smaller respiratory changes and greater immobility of the patient.

Key words: Deep sedation. Anesthesia, general. Atrial fibrilation. Ablation techniques. Catheter ablation.

INTRODUCTION

Atrial Fibrillation (AF) is the most common cardiac arrhythmia in clinical practice. Its incidence increases in male patients over 70 years old and it is associated with high morbidity and mortality; thromboembolic events are frequent. The need for anticoagulation is another factor that may give rise to complications[1-3]. Although treatment with antiarrhythmic drugs is effective in maintaining sinus rhythm, it has high incidence of adverse effects[4,5].

The intracavitary electrophysiological mapping with the identification of arrhythmogenic foci in atrial myocardial tissue and radiofrequency catheter ablation (RF) has been increasingly used for maintenance of sinus rhythm. The literature demonstrates the superiority of the results of this technique when compared to prolonged use of antiarrhythmics. The success rates of ablation, with absence of AF recurrence in one year, have ranged from 83.2% in paroxysmal AF to 64.8% in persistent one. Adverse events and complications account for a total of 4.5% in the current studies, the most frequent being cardiac tamponade, and the most feared, the silent cerebral thromboembolic events[6-13].

The application of RF for AF curative ablation is a lengthy and complex procedure that produces discomfort and chest pain which can be intense. It requires immobility for maintaining the stability of intracardiac catheters. Different anesthetic techniques are used for these procedures. The literature, however, is scarce[8] as for research that discuss advantages and disadvantages of the techniques, as well as to the establishment of specific guidelines on the subject. Most works show how the anesthetic technique used intravenous sedation (conscious or unconscious), based on the preference of the anesthesiologist or institutional protocols[14-17].

This study aims to compare the techniques of deep sedation and general anesthesia for curative ablation of atrial fibrillation and evaluate the hemodynamic and respiratory parameters, complications, and recurrence (outcome).

Work performed at the Post-Graduate Program in Surgical Sciences, Department of Surgery, Faculty of Medicine, Federal University of Rio de Janeiro – UFRJ, Rio de Janeiro – RJ, Brazil.

1. Anesthesiologist, Clementino Fraga Filho University Hospital, Faculty of Medicine, Federal University of Rio de Janeiro; 2. Associate Professor, Department of Surgery, Fluminense Federal University, Niterói; 3. Professor, Pathology, Federal University of Rio de Janeiro; 4. Associate Professor, Department of Surgery, Fluminense Federal University, Niterói; 5. Assistant Professor, Department of Surgery, Faculty of Medicine, Federal University of Rio de Janeiro.

METHODS

After approval by the Ethics Committee of the Clementino Fraga Filho University Hospital, of the Federal University of Rio de Janeiro (protocol 207/2009) and obtaining informed consents, we performed a prospective study with 32 patients, ASA 2 and 3, aged 18 and 65 years, of both genders, who were randomly divided into two groups of 16 subjects: deep sedation group (G1) and general anesthesia group (G2). All underwent ablation using the technique of circumferential electrical disconnection of the pulmonary veins guided by a non-fluoroscopic, three-dimensional (3D), electroanatomic mapping system. We recorded the time of the procedure, type of AF, associated diseases and medications used. No patient received premedication. Any antiarrhythmic drugs were maintained during the procedure.

Monitoring consisted of 12-leads electrocardiogram, pulse oximetry, capnometry and noninvasive blood pressure. A sensor was installed in the region dorsal to locate the position of the left atrium (LA), serving as guide for the electroanatomic mapping system (construction of left atrial geometry). After the use of intravenous midazolam (0.5 mg / kg), the radial artery was punctured for continuous blood pressure measurement and sampling of arterial blood gases assessment. G1 received venous propofol (1mg/kg) and a nasopharyngeal cannula was installed, as well as oxygen (4 to 6L/min) by facemask, and spontaneous ventilation. G2 received propofol (2mg/kg) and a laryngeal mask with gastric tube drainage was introduced on assisted , manual ventilation. Posteriorly, both groups received a continuous infusion, though with different dosages, of propofol (G1 = 25-50ìg/kg/min; G2 = 60-100ìg/kg/min) and remifentanil (G1 = 0.01-0.05 mg / kg / min; G2 = 0.06-0.1 mg / kg / min).

The diagnostic electrophysiology catheter was inserted into the esophagus through the laryngeal mask gastric draining tube (G2) or by nasogastric tube (G1). A virtual esophagus was created using the electroanatomic mapping system to measure esophageal temperature, which was observed that during the RF applications to avoid overheating and consequent atrial esophageal fistula formation in the areas of the esophagus near the left atrium. The femoral veins were punctured and the intracardiac catheters introduced.

After atrial transseptal puncture, circular catheters were placed on each pulmonary vein ostium in order to identify the electrical connections between the pulmonary veins and the left atrium. These points are the targets for the RF application that leads to electrical disconnection of the pulmonary veins. Heparin (100UI/kg) was injected intravenously in bolus after the atrial transseptal puncture and sequential doses of □ to □ of the initial dose were made in order to maintain the activated clotting time (ACT) above 320 seconds (sequential measurements were carried out every 30 minutes). At the end of the procedure, the catheters were removed when the ACT was normalized.

We analyzed the results of arterial blood gases obtained at the times M1 (before the onset of anesthesia), M2 and M3 (10 and 60 minutes after initiation of intravenous infusion of propofol and remifentanil, respectively) and M4 (20 minutes after the intravenous infusion). At the same time, only in G1 the level of sedation was evaluated by the Ramsay Sedation scale. We recorded mean arterial pressure, heart rate, total time of the procedure, time of permanence of the catheters in the left atrium; related diseases; complications (agitation, cough , perioperative mobility, transthoracic cardioversion, perioperative use of antiarrhythmic drugs, pacemaker implantation, ablation of other arrhythmias), respiratory depression, cardiac tamponade, thromboembolism, hypotension, bradycardia, asystole, nausea and vomiting, pulmonary vein stenosis, atrial esophageal fistula, femoral arteriovenous fistula or femoral thrombosis and recurrence or outcome after three months.

In the statistical analysis we used the following methods: for comparison of baseline (numerical) variables between groups (G1 and G2) we applied the Student t test for independent samples or Mann-Whitney (nonparametric) test. To compare categorical variables we used the Chi-square (÷2) test or Fisher exact test. We applied the analysis of variance (ANOVA) for repeated measures in the four moments: M1, M2, M3, M4, within each group, and the adjusted multiple comparison test of Bonferroni for the four moments. ANOVA was also used to check whether developments throughout the experiment were significantly different between groups. The analysis of power indicated that 17 patients would be required in each group for the study. The sample size was based on a 90% power, with a difference in the values found in alpha = 0.05.

RESULTS

The groups were homogeneous in age, weight, height, BMI and procedure time, except for the time of catheters permanence in the left atrium (Table 1). This variable was significantly higher in G2.

With regard to gender, physical status (ASA), type of atrial fibrillation, associated diseases and medications used, the results showed no significant differences between the two groups (Table 2).

The doses (mean ± Standard Deviation)of bolus intravenous propofol used were 73.13 ± 32.19 mg in G1 and 122.50 ± 26.20 mg in G2; continuous infusion doses were 48.75 µg/kg/min ± 10.41 in G1 and 85.94 µg/kg/min ± 7.35 in G2. The infusion doses of remifentanil were 0.02 µg/kg/min ± 0.01 in G1 and 0.08 µg/kg/min ± 0.01 in G2. The level of sedation by the Ramsay scale was kept in '5' and '6' in G1, evaluated at moments M2 and M3.

Table 1 - Patient characteristics: age, weight, height, BMI, procedure time and permanence of the catheters in the left atrium.

Variable	G1		G2		*p value*
	mean ± SD	median	mean ± SD	median	
Age (years)	53.7 ± 8.6	56.5	55.1 ± 9.0	58.5	0.66
Weight (kg)	75.9 ± 10.4	77	71.6 ± 8.3	72	0.21
Height (cm)	170.9 ± 8.7	170	172.6 ± 8.7	174.5	0.58
BMI (kg/m^2)	25.7 ± 2.9	26	24.2 ± 2.3	24	0.12
Time of procedure (min)	147.2 ± 34.2	150	165.1 ± 33.2	172.5	0.14
TCP (min)	91.3 ± 25.2	85.0	125.0 ± 33.2	115.0	0.002

G1: deep sedation; G2: general anesthesia, min: minute, BMI: body mass index; TCP: time of catheter permanence in the left atrium (p = 0.002, significant), SD: standard deviation, Student's t or Mann-Whitney tests.

Table 2 - Gender, ASA, diagnosis, associated conditions and medication use.

Variable	G1		G2		*p value* [a]
	N	%	n	%	
Gender					
Male	10	62.5	10	62.5	1.0
Female	6	37.5	6	37.5	
ASA					
2I	7	43.8	7	43.8	1.0
3	9	56.3	9	56.3	
AF					
Paroxystic	9	56.3	11	68.8	0.46
Persistent	7	43.8	5	31.3	
Arterial hipertension	11	68.8	9	56.3	0.46
Diabetes mellitus	1	6.3	4	25.0	0.16
Anti-hipertensive	10	62.5	10	62.5	1.0
Antiarrhythmic	16	100.0	16	100.0	NSA
Diuretics	11	68.8	9	56.3	0.46
Hypoglycaemic agents	1	6.3	4	25.0	0.16
Anticoagulant	16	100.0	15	93.8	pc
Beta-blocker	0	0.0	0	0.0	NSA

G1: deep sedation; G2: general anesthesia; NSA: not applicable; fc: few cases (less than five patients without use of anti coagulant); n = number; [a]: Fisher exact test.

There were significant differences in pH between moments studied in G1 (p = 0.0001) and G2 (p = 0.0001) and also in the behavior of the two groups (p = 0.0001). In G1 there was significant decrease in the pH of M1 (7.372 ± 0.033) from M2 (7.281 ± 0.071) to M3 (7.286 ± 0.050) and increase from M2 and M3 to M4 (7.343 ± 0.032), showing a U-type evolution. In G2 there was significant increase from M2 (7.384 ± 0.043) to M3 (7.419 ± 0.052) and significant decrease from M2 and M3 to M4 (7.347 ± 0.036). The evolution in G2 was comparatively more stable, with a significant increase from M2 to M3 and final decrease (p = 0.0001). It was concluded that the groups have evolved differently, with a significant increase of pH in G1, which was recovered at the final moment, M4 (Figure 1).

There were significant differences in the behavior of measurements of blood pressure and carbon dioxide ($PaCO_2$) within groups (p = 0.0001) and between the two groups (p = 0.0001) throughout the experiment. In G1 there was significant increase in PaCO2 from M1 (41.9 ± 5.6 mmHg) to M2 (53.0 ± 6.0 mmHg) and M3 (55.1 ± 8.9 mmHg), and significant decrease from M2 and M3 to M4 (45.2 ± 4.1 mmHg). G2 measures of PaCO2 showed a significant decrease from M1 (41.0 ± 2.6 mmHg) to M2 (39.6 ± 5.6 mmHg) and M3 (35.0 ± 5.0 mmHg), and significant increase from M1, M2 and M3 to M4 (46.0 ± 1.7 mmHg). The groups have evolved in different ways, with G1 presenting the highest values of PaCO2 and G2 the smallest, especially when comparing M2 with M3. Both groups, G1 and G2, presented values close to the initial

moment (M1) at the end of the experiment (M4) (Figure 2).

We found a significant decrease in the values of arterial oxygen pressure (PaO_2) at time M4 (G1 = 90.0 ± 9.4 mmHg; G2 = 96.4 ± 3.0 mmHg) when compared to M2 (G1 = 253.5 ± 91.1 mmHg; G2 = 284.9 ± 84.2 mmHg) and M3 (G1 = 250.5 ± 99.6 mmHg; G2 = 284.9 ± 84.2 mmHg). There were significant differences in the values of PAO_2 within the two groups (p = 0.0001). However, no significant difference was observed in the evolution of PaO_2 throughout the experiment between the two groups (p = 0.64) (Figure 3).

There was significant variation in arterial oxygen saturation (SpO_2) within G1 and G2 (p = 0.0001). We identified a significant reduction of the mean values of SpO_2 in M4 (G1 = 96.3 ± 1.64; G2 = 96.8 ± 1.31%) when these values were compared to the moments M2 (G1 = 99.4 ± 0.44%, G2 = 99.6 ± 0.28%) and M3 (G1 = 98.7 ± 2.50; G2 = 99.6 ± 0.28). This behavior was the same during the experiment for both groups G1 and G2 (p = 0.64).

We observed a significant variation in the mean arterial pressure (MAP) only in G2 (p = 0.0001). There was also a significant reduction in MAP from M1 to M2 and M3 and increased values from M2 and M3 to M4 (p = 0.0001).

The values of heart rate (HR) in G1 showed no significant variations between the four moments. Only the G2 group had a significant decrease in HR when M3 (55.5 ± 12.33 bpm) was compared to M1 (65.9 ± 8.22 bpm) and there was also an increase in HR at M4 (72.1 ± 9.14 bpm) when compared to M2 (60.3 ± 9.44 bpm) and M3 (55.5 ± 12.33 bpm), denoting a return to values close to the time of the procedure beggining (M1). The difference occurred between groups was significant (p = 0.011).

Concerning the complications, cough (mobility) had a higher incidence in five patients from G1 (31%) and two from G2 (12.5%, p <0.001). Only one patient in G1 presented with apnea and received manual ventilation by face mask, and therefore was excluded from the study. In five patients in G1 and in four in G2 a transthoracic cardioversion of AF was required. One patient from G1developed pericardial effusion, diagnosed and monitored by transesophageal echocardiography, though without

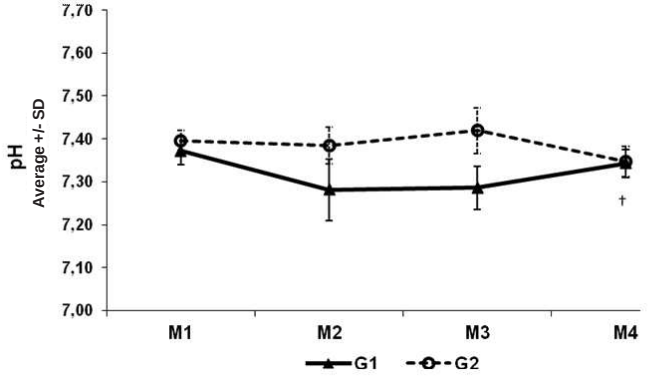

Figure 1 - *Serial measurements of pH. G1: Deep sedation, G2: general anesthesia. Data as mean ± SD (standard deviation). M1 = before anesthesia, M2 = 10 min of anesthesia, M3 = 60 min of anesthesia and M4 = 20 min after anesthesia; G1 versus G2 (p = 0.0001); Ï% p = 0.0001, M2, M3 versus M1 (G1); † p = 0.0001, M4 versus M1, M2, M3 (G1); ‡ p = 0.0001, M3 versus M2 (G2); Ï% p = 0.0001, M1, M2, M3 versus M4 (G2). ANOVA test to intra-group and between-groups comparison. Adjusted Bonferroni test Performed; 5% significance level.*

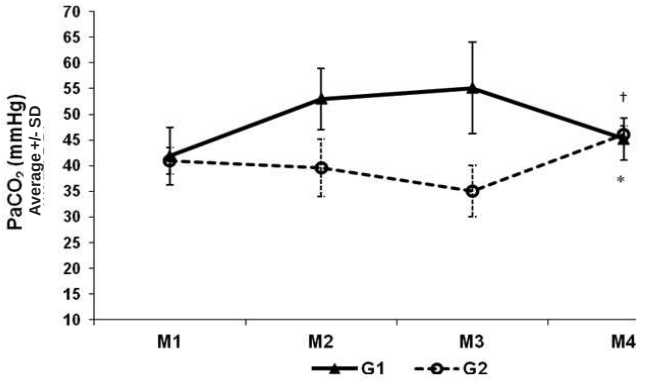

Figure 2 - *Serial measurements of PaCO2. G1: Deep sedation, G2: general anesthesia. Data as mean ± SD (standard deviation). M1 = before anesthesia, M2 = 10 min of anesthesia, M3 = 60 min of anesthesia and M4 = 20 min after anesthesia; G1 versus G2 p = 0.0001, G1* versus *G2; Ï%p = 0.0001, M2, M3* versus *M1 (G1); †p = 0.0001, M4* versus *M2 and M3 (G1); ‡p = 0.0001, M3* versus *M1 and M2 (G2); Ï%p = 0.0001, M4* versus *M1, M2 and M3 (G2). ANOVA test to intra-group and between-groups comparison. Adjusted Bonferroni test Performed; 5% significance level.*

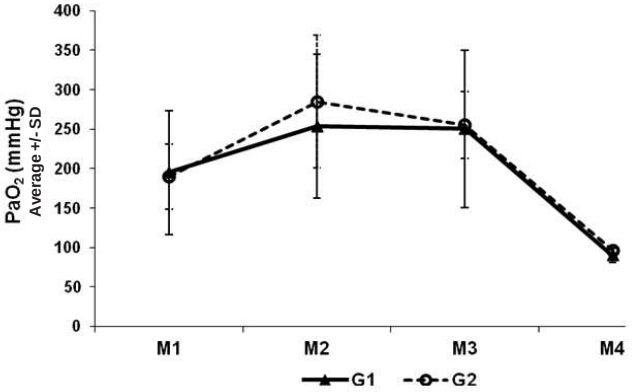

Figure 3 - *Serial measurements of PaO_2. G1: Deep sedation, G2: general anesthesia. Data as mean ± SD (standard deviation). M1 = before anesthesia, M2 = 10 min of anesthesia, M3 = 60 min of anesthesia and M4 = 20 min after anesthesia; G1* versus *G2: p= 0,67; Ï%p= 0.0001, M4* versus *M1, M2 and M3 (G1 and G2). ANOVA test to intra-group and between-groups comparison. Adjusted Bonferroni test Performed; 5% significance level.*

drainage. Only two patients from G2 had nausea and vomiting after the procedure. The recurrence (outcome) at three months showed no significant difference between the two groups (Table 3).

DISCUSSION

The use of ablation for the curative treatment of AF has increased significantly due to its safeness and effectiveness. It has also been the therapeutic solution of choice when compared to antiarrhythmic drugs because it offers the chance of permanent cure with significant improvement in patients' quality of life[11,12].

The literature is still scarce[8] as regards the choice of the best anesthetic technique to be employed. Although different sedation techniques have been proposed by the North American Society of Pacing and Electrophisiology / NASPE[13,14], the choice has been based on the patient's clinical condition, on institutional protocols and on the anesthesiologist's preference.

Tang *et al.*[15] compared conscious sedation using midazolam/fentanyl with unconscious sedation with propofol and showed that the latter had a higher incidence of respiratory complications such as hypoventilation, hypoxia, cough and upper respiratory obstruction. In this research, we chose to use midazolam, propofol and remifentanil in both groups. Nevertheless, the same results of Tang *et al* [15] were found in the group with deep sedation.

Zaballos *et al.*[16] concluded that the hemodynamic effects of remifentanil are associated with decreased vagal tone, being able to produce marked decrease in heart rate.

It was found that the patients in G2 at time M3 showed lower heart rate (55.5 ± 12.33 bpm) than G1 (69.5 ± 12.78 bpm). The higher doses of remifentanil in the latter group justify this effect. Leite *et al.*[17] used low doses of remifentanil in 16 patients undergoing electrophysiologic study and concluded that this drug would not be ideal for this type of procedure because it produced a delay in cardiac conduction and refractoriness. The results obtained in this study, corroborating Leite *et al.*, demonstrated that remifentanil used in low doses (0.025 to 0.075) may have altered atrial electrical properties. Thus, this drug may have prolonged the time of atrial electrical activity mapping and then produced an increase in the time of catheters permanence in the left atrium (LA). However, this fact did not cause changes in the outcome of ablation, since the total time of the procedure and the incidence of recurrence (outcome) after three months were similar for both techniques (G1 and G2).

The breathing and patient movement during the procedure can interfere both with the stability of the RF application catheter tip and with the positioning of the AE position sensor (patch) placed in the dorsal region of the patient. This fact raises an improper contact between the catheter tip and myocardial tissue, the immobility of the atrial wall being essential to the quality and success of ablation[18].

The RF ablation is a prolonged procedure, causing intense pain and chest discomfort to patients. Di Biase *et al.*[18] demonstrated that both conscious sedation as general anesthesia were effective for AF ablation. However, AF cure rates without recurrence were higher in patients undergoing general anesthesia, which was attributed to greater immobility of the patient, allowing regular and better controlled thoracic expansions. Furthermore, the AE position sensor remained better fixed and the procedure sustained fewer interruptions to its repositioning. They concluded that RF applications were more effective due to the more intimate and durable contact of the catheter tip with the myocardial tissue rendered possible by greater immobility of the patient. They considered the stability of the RF application catheter tip extremely important to the success of the ablation procedure. The results of our study showed recurrence similar in both groups (G1 = 25%, G2 = 18.7%), differing from the work of Di Biase *et al.*[18], who also used a larger number of patients, which may have influenced their results.

Concerning the complications, cough during ablation may result from obstruction of the upper airways

Table 3 - Recurrence and complications.

Complications	G1 (n = 16)		G2 (n = 16)		*p value* [a]
	N	%	n	%	
Recurrence (3 months)	4	25.0	3	18.7	0.50
Cough (causing mobility)	5	31%	3	12.5%	**0.001**
Cardioverted AF	5	31.3	4	25.0	0.50
Haemopericardium	0	0	1	6.3	0.50
Agitation or AF cardioversion or hemopericardium	5	31.3	5	31.3	0.64
Others	10	62.5	8	50.0	0.36

G1: deep sedation; G2: general anesthesia, n: number of patients; %: percentage; Others: intraoperative complications (awareness, use of antiarrhythmic drugs, pacemaker implantation, ablation of other arrhythmias, agitation and asystole), postoperative complications (nausea and vomiting, pulmonary vein stenosis, arteriovenous fistula, thromboembolism, femoral thrombosis, atrial-esophageal fistula), Cough (causing movement): (p = 0.001, significant); [a]: Fisher exact test.

or stem bronchi stimulation adjacent to the posterior wall of the left atrium, and may contribute to the destabilization of catheters, cause disruptions in the procedure ablation, providing a greater chance of cardiac perforation[15]. In this study, we observed a lower incidence of cough and immobility in the group with adequate general anesthesia (12.5%) when compared to the group under deep sedation (31%).

Patients with deep sedation (G1) showed increased values of $PaCO_2$, justifying the decrease in pH. The G2 patients showed no such changes, though. Hypoventilation may have occurred due to the central action of intravenous anesthetics, since the occurrence of upper respiratory obstruction was immediately treated with nasal and oropharyngeal cannulas. Trentman *et al.*[19], in a study of 208 patients undergoing various types of electrophysiological procedures under sedation, found that 40% of patients required some form of intervention in the upper airways, corroborating the results of this work. The arterial oxygen pressure and arterial oxygen saturation remained at normal levels and displayed the same behavior throughout the procedure for both groups, due to the greater provision of oxygen (O_2) supplied by the two techniques. In the recovery phase (M4) groups showed a return to normal levels of PaO_2 after withdrawal of additional oxygen. The airway management with laryngeal mask (G2) allowed assisted ventilation and was more effective in maintaining the levels of $PaCO_2$.

Di Biase et *al.*[18] obtained shorter procedure and fluoroscopy times in patients undergoing general anesthesia. In contrast, the present study found a similar procedure total time for both groups.

Bradycardia and hypotension caused by remifentanil, even at doses of 0.1 ìg/kg/min, are related to a central effect of inhibition of sympathetic tone and vagal exacerbation. They tend to be accentuated when combined to the hemodynamic effects of propofol (cardiovascular depression with decreased systemic vascular resistance and myocardial contractility). However, these changes were not important for the procedure outcome (success rate without relapse)[20-22].

Based on studies that evaluated the risk of esophageal injury during AF ablation[23-28], we opted to use laryngeal mask with tube drainage, for it causes no interference in esophageal movement and provides easy access to the diagnostic catheter inserted into the esophagus, thus reducing the risk of atrial esophageal fistula, a rare and serious complication. Laryngeal mask also enables the assisted or controlled ventilation during the procedure and allows better control of respiratory function and greater immobility.

The complication rates in this study were similar to those observed by other authors[1,3,16,29,30] and were similar for both groups. The incidence of recurrence (outcome) of AF in three months was equal in both G1 and G2.

This study had the limitation of not being covered, with potential for bias. Due to technical problems, we included 32 patients and not 34, as described in the study power of analysis.

We conclude that both techniques can be used for curative ablation of atrial fibrillation. General anesthesia had lower respiratory changes and provided greater immobility of patients.

R E S U M O

Objetivo: *Comparar sedação profunda com anestesia geral para ablação curativa de fibrilação atrial.* ***Métodos:*** *Estudo prospectivo, aleatório, com 32 pacientes, idades entre 18 e 65 anos, ASA 2 e 3, IMC d" 30kg/m², distribuídos em dois grupos: sedação profunda (G1) e anestesia geral (G2). Todos receberam midazolan (0,5mg/kg) venoso. O G1 recebeu propofol (1mg/kg) e máscara facial de O_2, seguido da infusão contínua de propofol (25-50mg/kg/min) e remifentanil (0,01-0,05µg/kg/min). O G2 recebeu propofol (2mg/kg) e máscara laríngea com tubo de drenagem, seguido da infusão contínua de propofol (60-100mg/kg/min) e remifentanil (0,06-0,1µg/kg/min). Foram comparados: frequência cardíaca, pressão arterial invasiva, complicações, recidiva (desfecho) em três meses e gasometrias.* ***Resultados****: Os pacientes do G1 apresentaram gasometrias arteriais com níveis de $PaCO_2$ maiores e pH menores (p=0,001) e maior incidência de tosse. Ocorreu diminuição da PAM e FC no G2. Exceto a tosse, as complicações e recidivas foram semelhantes em ambos os grupos.* ***Conclusão:*** *Ambas as técnicas podem ser utilizadas para a ablação curativa da fibrilação atrial. A anestesia geral proporcionou menores alterações respiratórias e maior imobilidade do paciente.*

Descritores: *Sedação profunda. Anestesia geral. Fibrilação atrial. Técnicas de ablação. Ablação por cateter002E.*

REFERENCES

1. Wazni O, Wilkoff B, Saliba W. Catheter ablation for atrial fibrilation. N Engl J Med. 2011;365(24):2296-304.
2. Iwasaki YK, Nishida K, Kato T, Nattel S. Atrial fibrillation pathophysiology: implications for management. Circulation. 2011;124(20):2264-74.
3. Cappato R, Calkins H, Chen SA, Davies W, Iesaka Y, Kalman J, et al. Update worldwide survey on the methods, efficacy, and safety of catheter ablation for human atrial fibrillation. Circ Arrhythm Electrophysiol. 2010;3(1):32-8.
4. Rodgers M, Mckenna C, Palmer S, Chambers D, Van Hout S, Golder S, et al. Curative catheter ablation in atrial fibrillation and typical atrial flutter: systematic review and economic evaluation. Health Technol Assess. 2008;12(34):iii-iv,xi-xiii,1-198.

5. Sullivan SD, Orme ME, Morais E, Mitchell SA. Interventions for the treatment of atrial fibrillation: A systematic literature review and meta-analysis. Int J Cardiol. 2012; Mar 31. [Epub ahead of print]
6. Willems S, Drewitz I, Steven D, Hoffmann BA, Meinertz T, Rostock T. Interventional therapy of atrial fibrillation: possibilities and limitations. Dtsch Med Wochenschr. 2010;135 Suppl 2:S48-54.
7. Lee G, Sparks PB, Morton JB, Kistler PM, Vohra JK, Medi C, et al. Low risk of major complications associated with pulmonary vein antral isolation for atrial fibrillation: results of 500 consecutive ablation procedures in patients with low prevalence of structural heart disease from a single center. J Cardiovasc Electrophysiol. 2011;22(2):163-8.
8. Kumagai K. Catheter ablation of atrial fibrillation. -State of the Art-. Circ J. 2011;75(10):2305-11.
9. Callahan TD 4th, Di Biase L, Horton R, Sanchez J, Gallinghouse JG, Natale A. Catheter ablation of atrial fibrillation. Cardiol Clin. 2009;27(1):163-78,x.
10. Pappone C, Augello G, Sala S, Gugliotta S, Vicedomini G, Gulletta S, et al. A randomized trial of circunferential pulmonary vein ablation versus antiarrythmic drug therapy in paroxysmal atrial fibrillation: the APAF Study. J Am Coll Cardiol. 2006;48(11):2340-7.
11. Wilber DJ, Pappone C, Neuzil P, De Paola A, Marchlinski F, Natale A, et al. Comparison of antiarrhythmic drug therapy and radiofrequency catheter ablation in patients with paroxysmal atrial fibrillation: a randomized controlled trial. JAMA. 2010;303(4):333-40.
12. Maciel WA, Atié J. Tratamento não-farmacológico da fibrilação atrial: Sua evolução e estado da arte. Rev SOCERJ. 2006;19(1):66-73.
13. Fuster V, Rydén LE, Cannom DS, Crijns HJ, Curtis AB, Ellenbogen KA, et al. 2011 ACCF/AHA/HRS focused updates incorporated into the ACC/AHA/ESC 2006 Guidelines for the management of patients with atrial fibrillation: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines developed in partnership with the European Society of Cardiology and in collaboration with the European Heart Rhythm Association and the Heart Rhythm Society. J Am Coll Cardiol. 2011;57(11):e101-98.
14. Gaitan BD, Trentman TL, Fassett SL, Mueller JT, Altemose GT. Sedation and analgesia in the cardiac electrophysiology laboratory: a national survey of electrophysiologists investigating the who, how, and why? J Cardiothorac Vasc Anesth. 2011; 25(4):647-59.
15. Tang RB, Dong JZ, Zhao WD, Liu XP, Kang JP, Long DY, et al. Unconscious sedation/analgesia with propofol versus conscious sedation with fentanil/midazolam for catheter ablation of atrial fibrillation: a prospective, randomized study. Chin Med J (Engl). 2007;120(22):2036-8.
16. Zaballos M, Jimeno C, Almendral J, Atienza F, Patiño D, Valdes E, et al. Cardiac electrophysiological effects of remifentanil: study in a closed-chest porcine model. Br J Anaesth. 2009;103(2):191-8.
17. Leite SS, Firme EBP, Bevilaqua MS, Pereira LS, Atié J. Estudo prospectivo das repercussões de baixas doses de remifentanil na função sinoatrial e na condução e refratariedade cardíaca. Rev bras anestesiol. 2007;57(5):465-75.
18. Di Biase L, Conti S, Mohanty P, Bai R, Sanchez J, Walton D, et al. General anesthesia reduces the prevalence of pulmonary vein reconnection during repeat ablation when compared with conscious sedation: results from a randomized study. Heart Rhythm. 2011;8(3):368-72.
19. Trentman TL, Fassett SL, Mueller JT, Altemose GT. Airway interventions in the cardiac electrophysiology laboratory: a retrospective review. J Cardiothorac Vasc Anesth. 2009;23(6):841-5.
20. Mandel JE, Hutchinson MD, Marchlinsk FE. Remifentanil-midazolan sedation provides hemodynamic stability and comfort during epicardial ablation of ventricular tachycardia. J Cardiovasc Electropohysiol. 2011:22(4):464-6.
21. Calkins H, Kuck KH, Cappato R, Brugada J, Camm AJ, Chen SA, at al. 2012 HRS/EHRA/ECAS Expert Consensus Statement on Catheter and Surgical Ablation of Atrial Fibrillation: recommendations for patient selection, procedural techniques, patient management and follow-up, definitions, endpoints, and research trial design. Europace. 2012;14(4):528-606.
22. Fenelon G, Scanavacca M, Atié J, Zimerman L, Magalhães LP, Lorga Filho A, et al. Ablação da fibrilação atrial no Brasil: resultados do registro da Sociedade Brasileira de Arritmias Cardíacas. Arq bras cardiol. 2007;89(5):285-9.
23. Di Biase L, Saenz LC, Burkhardt DJ, Vacca M, Elayi CS, Barrett CD, et al. Esophageal capsule endoscopy after radiofrequency catheter ablation for atrial fibrillation: documented higher risk of luminal esophageal damage with general anesthesia as compared with conscious sedation. Cir Arrythm Electrophysiol. 2009;2(2);108-12.
24. Metzner A, Schmidt B, Fuernkranz A, Wissner E, Tilz RR, Koester I, et al. Esophageal temperature change and esophageal thermal lesions after pulmonary vein isolation using the novel endoscopic ablation system. Heart Rhythm. 2011;8(6):815-20.
25. Bahnson TD. Strategies to minimize the risk of esophageal injury during catheter ablation for atrial fibrillation. Pacing Clin Electrophysiol. 2009;32(2):248-60.
26. Pappone C, Oral H, Santinelli V, Vicedomini G, Lang CC, Manguso F, et al. Atrio-esofageal fistula as a complication of percutaneos transcatheter ablation of atrial fibrillation. Circulation. 2004;109(22):2724-6
27. Sherzer AI, Feigenblum DY, Kulkarni S, Pina JW, Casey JL, Salka KA, et al. Continuous nonfluoroscopic localization of the esophagus during radiofrequency catheter ablation of atrial fibrillation. J Cardiovasc Electrophysiol. 2007;18(2):157-60. Erratum in: J Cardiovasc Electrophysiol. 2007;18(4):458.
28. Chugh A, Rubenstein J, Good E, Ebinger M, Jongnarangsin K, Fortino J, et al. Mechanical displacement of the esophagus in patients undergoing left atrial ablation of atrial fibrillation. Heart Rhythm. 2009;6(3):319-22.
29. Letsas KP, Efremidis M, Charalampous C, Tsikrikas S, Sideris A. Current ablation strategies for persistente and long-standing atrial fibrillation. Cardiol Res Pract. 2011;2011:376969.
30. Bertaglia E, Zoppo F, Tondo C, Colella A, Mantovan R, Senatore G, et al. Early complications of pulmonary vein catheter ablation for atrial fibrillation: a multicenter prospective registry on procedural safety. Heart Rhythm. 2007;4(10):1265-71.

Received on 07/05/2012
Accepted for publication 09/07/2012
Conflict of interest: none
Source of funding: no

How to cite this article:
Firme EBP, Cavalcanti IL, Barrucand L, Assad AR, Figueiredo NV. Curative ablation of atrial fibrillation: comparison between deep sedation and general anesthesia. Rev Col Bras Cir. [periódico na Internet] 2012; 39(6). Disponível em URL: http://www.scielo.br/rcbc

Address for correspondence:
Elizabeth Bessadas Penna Firme
E-mail: bessadaspf@superig.com.br