Propofol anaesthesia for elective electrical cardioversion among patients in various age groups

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Abstract

Background: Electrical cardioversion using propofol as a sole hypnotic agent is a frequent, standard procedure. The aim of this study was to compare the course of anaesthesia with propofol for this procedure among patients in various age groups.
Material and Methods: 50 patients, aged 32 to 87 years, underwent elective electrical cardioversion for various atrial arrhythmias. Patients were stratified into two age groups – group I (≤65 years, n=31) and group II (>65 years, n=19). Patients were given propofol (bolus 1 mg kg^{-1}, followed by increments containing 20% of the initial dose) as a sole agent.
Results: Haemodynamic parameters were similar in both groups. Anaesthesia and awakening times were not significantly different between groups. Anaesthesia time was 10.7±3.1 min. for group I and 10.6±2.9 min. for group II, while awakening time was 4.8±2.5 min. for group I and 4.7±1.8 min. for group II. Mean use of propofol, number of electrical impulses and total electrical energy delivered to regain sinus rhythm were significantly higher in younger patients. Propofol dose required to provide anaesthesia was 1.81±0.51 mg/kg in group I and 1.49±0.46 mg/kg in group II (p=0.026). Overall, electrical cardioversion was successful in 77% of patients in the younger group and in 89% of patients in the older group (p=NS). Maximal motor response to consecutive electrical impulses was less pronounced in older patients. Frequency of side-effects was not statistically different between groups apart from more incidents of apnoea among older patients (0 vs. 15.8%).
Conclusion: Electrical cardioversion with titrated administration of propofol as a sole agent is safe for patients in various age groups. Apnoea and mild desaturation are more frequent in older patients, whereas younger patients may present more pronounced motor response and require a higher dose of the hypnotic agent.
Key words: cardioversion, propofol, anaesthesia.

Streszczenie

Wstęp: Kardiowersja elektryczna z użyciem propofolu jako środka znieczulenia ogólnego jest często wykonywanym, rutynowym zabiegiem. Celem pracy było porównanie przebiegu znieczulenia propofolem do kardiowersji elektrycznej pomiędzy pacjentami w różnych grupach wiekowych.
Materiał i metody: 50 chorych w wieku od 32 do 87 lat zostało poddanych planowej kardiowersji elektrycznej z powodu różnych przedsionkowych zaburzeń rytmu serca. Chorzy zostali zakwalifikowani do dwóch grup wiekowych – grupy I (wiek ≤65 lat, n=31) oraz grupy II (wiek >65 lat, n=19). Pacjenci otrzymywali wyłącznie propofol w dawce wstępnej wynoszącej 1 mg kg^{-1}, zaś kolejne dawki miareczkowano, podając po 20% dawki wstępnej w zależności od reakcji chorego.
Wyniki: Parametry hemodynamiczne okazały się zbliżone w obu grupach. Czas znieczulenia i wybudzenia nie były istotnie różne. Czas znieczulenia wynosił 10,7±3,1 min w grupie I i 10,6±2,9 min w grupie II, podczas gdy czas budzenia ze znieczulenia wynosił 4,8±2,5 min w grupie I i 4,7±1,8 min w grupie II. Średnie zużycie propofolu, ilość impulsów elektrycznych oraz łączna dostarczona energia elektryczna niezbędna dla przywrócenia rytmu zatokowego były istotnie wyższe u młodszych chorych. Dawka propofolu niezbędna do przeprowadzenia znieczulenia wynosiła 1,81±0,51 mg/kg w grupie I i 1,49±0,46 mg/kg w grupie II (p=0,026). Ogółem kardiowersja elektryczna okazała się skuteczna u 77% chorych w młodszej grupie i u 89% chorych w starszej grupie (p=NS). Maksymalna odpowiedź motoryczna na kolejne impulsy elektryczne była istotnie mniej zaznaczona u starszych chorych. Częstość występowania objawów ubocznych okazała się zbliżona, poza częściej występującymi incydentami bezdechu u starszych chorych (0 *vs* 15,8%).
Wniosek: Kardiowersja elektryczna przy użyciu propofolu jako jedynego środka i przy jego ostrożnym miareczkowaniu jest bezpieczna u chorych w różnych grupach wiekowych. Bezdech i nieznaczna desaturacja są częstsze u starszych chorych, podczas gdy młodsi chorzy prezentują bardziej zaznaczoną reakcję motoryczną i wymagają wyższych dawek anestetyku.
Słowa kluczowe: kardiowersja, propofol, anestezja.

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Introduction

Electrical cardioversion (EC) is a frequent, standard procedure in cardiology and cardiac surgery. It may even be considered a day case if a patient is in a good clinical condition, but it requires short-term general anaesthesia [1].

James et al. published the results of a survey performed in 2003 to answer the question of which anaesthetic technique is currently the most popular for EC in the United Kingdom. A special questionnaire was sent to 150 randomly chosen hospitals – propofol was found to be the most popular agent [1]. It may be a matter of debate which type of analgesic (fentanyl or remifentanil) should be used in addition to propofol as a hypnotic [2]; however, propofol is also frequently used as a sole agent [3].

EC may be performed in patients with significant comorbidities and in various clinical conditions. It is not clear what kind of problems may appear during this frequent procedure and what the impact of patient's age is. The aim of this study was to compare the course of anaesthesia with propofol for EC and the frequency of adverse events during this procedure among patients in various age groups.

Material and Methods

This prospective, observational study was performed in 50 consecutive patients (aged 32 to 87 years) scheduled for elective EC. Patients were stratified into two age groups: group I (≤65 years, n=31) and group II (>65 years, n=19). Routine hospital management was used during the study and all patients gave their written informed consent for EC and general anaesthesia.

All patients received propofol 1 mg/kg (Propofol, Fresenius) in the initial dose, followed by increments of 0.2 mg/kg each to achieve general anaesthesia. Inability to open the eyes on command and the lack of eyelid reflex were considered as the criteria to recognize the status of general anaesthesia. Patients were allowed to breathe room air spontaneously during the procedure. Temporary respiratory support was performed only if apnoea >30 seconds was observed and/or oxygen saturation dropped below 90%.

Patients were not scheduled for the study if they were classified as ASA IV or V, ejection fraction of the left ventricle was lower than 30%, or EC was done on an emergency basis. Patients were also not included in the study if they were haemodynamically unstable, had unstable angina or severe circulatory insufficiency (NYHA IV) and also when they received intravenous medications (vasodilators and/or inotropic agents), or were mechanically ventilated. Once the patient was registered, there were no exclusions during the study – each patient was planned to be included in a statistical analysis.

All patients were routinely treated. The last dose of the patient's usual oral medications was given in the morning on the day when the procedure was done. Premedication was not used. Basic vital signs (heart rate, non-invasive blood pressure, oxygen saturation) were noted before the induction of anaesthesia (T1), before EC (T2), after EC (T3) and after awakening (T4). Anaesthesia and recovery times were registered for each patient. The lack of eyes opening on command and the lack of eyelid reflex were considered as the criteria to recognize lack of consciousness. Awake state was recognized when the patient was able to open eyes on command. Aldrette score was calculated to estimate degree of awakening. Anaesthesia time was counted from the moment when the patient lost consciousness to the moment of awakening. Recovery time was counted from the moment of awakening to the moment when a patient was able to achieve 10 points in the Aldrette score (full awakening).

Efficacy of EC was assessed during anaesthesia. Uniphasic defibrillator/cardioverter (Medtronic Lifepak Physio – Control type 9P or 10) was used. Electrical current was used up to four times in a standard sequence: 100 J, 200 J, 360 J (classic location of the pads) and 360 J (antero-posterior location of the pads). For the purpose of this study, a scale to describe the degree of motor response to EC was invented and the strongest reaction for each patient was noted:

1° – no reaction,
2° – raising of the forearms,
3° – raising of the forearms and arms,
4° – raising of all limbs, without awakening,
5° – awakening as a response to EC.

Side-effects and complications were noted. Side-effects were recognized if the observer registered: pain on injection of the study drug, nausea, vomiting, muscle tremor, or apnoea with the need for respiratory support. Complications were recognized if the observer registered: cardiac arrest, severe bradycardia, tracheal intubation, the use of emergency medications or other serious adverse events with the need for various forms of emergency medical management.

Initial demographic data are shown in Table I. Patients in group II had some obvious differences (age, height, body weight) when compared with group I. There were also significantly more women in the older group. Other data were comparable.

Numerical data are presented as mean and standard deviation. T-test, Mann-Whitney test, or ANOVA with post-hoc Sheffe comparisons and Fisher's exact tests were used, if appropriate, for statistical analysis and a p value below 0.05 was considered significant.

Results

Before, during and after anaesthesia, mean values of heart rate and systolic arterial blood pressure were similar in both groups. Oxygen saturation was higher during anaesthesia in group I, but no differences were observed after the patient's awakening. Comparisons to the baseline revealed that the values of haemodynamic parameters significantly decreased during anaesthesia (Tab. II).

Anaesthesia time was 10.7±3.1 min. for group I and 10.6±2.9 min. for group II (p=NS). Awakening time (from opening eyes on verbal command to the moment when a patient achieved Aldrette score of 10) was also similar in both groups (4.8±2.5 min. for group I vs. 4.7±1.8 min. for group II, p=NS).

Tab. I. Demographic data

Parameter		Group I (n=31)	Group II (n=19)	p
age (years)		56.7±7.8	74.1±5.2	<0.001
height (cm)		174.1±8.3	166.8±8.5	<0.01
body weight (kg)		88.6±13.7	77.9±13.5	<0.01
BMI (kg/m^2)		29.3±4.2	27.9±4.0	NS
ejection fraction of the left ventricle (%)		52.1±7.8	51.7±8.9	NS
sex	male	27 (87.1%)	10 (52.6%)	<0.05
	female	4 (12.9%)	9 (47.4%)	
NYHA class	I	23 (74.2%)	14 (73.7%)	NS
	II	7 (22.6%)	4 (21.1%)	
	III	1 (3.2%)	1 (5.3%)	
arterial hypertension		23 (74.2%)	11 (57.9%)	NS
anaesthesia risk (ASA)	2	10 (32.3%)	5 (26.3%)	NS
	3	20 (64.5%)	14 (73.7%)	
	4	1 (3.2%)	0 –	
previous use of beta-blocking agents		21 (67.7%)	16 (84.2%)	NS

Tab. II. Haemodynamic data and oxygen saturation during anaesthesia

Parameter		Group I (n=31)	Group II (n=19)	p
heart rate (beats/min.)	T1	95.8±23.2	91.1±21.8	NS
	T2	97.7±24.1	87.6±17.7	
	T3	*72.1±3.4	*60.0±20.5	
	T4	*69.4±20.7	*66.1±10.9	
systolic blood pressure (mmHg)	T1	129.7±16.5	129.2±16.2	NS
	T2	*117.6±16.2	*114.7±13.2	
	T3	*119.4±16.9	*116.6±22.5	
	T4	*117.6±26.3	*111.8±18.0	
diastolic blood pressure (mmHg)	T1	83.7±6.6	81.3±10.3	NS
	T2	77.3±10.3	75.3±9.8	
	T3	79.8±13.6	77.4±13.5	
	T4	77.9±8.2	*71.8±11.8	
oxygen saturation (%)	T1	97.2±0.8	97.3±0.9	NS
	T2	97.2±1.6	96.7±2.5	NS
	T3	95.5±2.3	*91.6±8.2	**<0.01**
	T4	96.5±1.7	96.9±1.5	NS

** – test for repeated measurements, comparison within the group, values significantly different to baseline; p – comparison between the groups.*

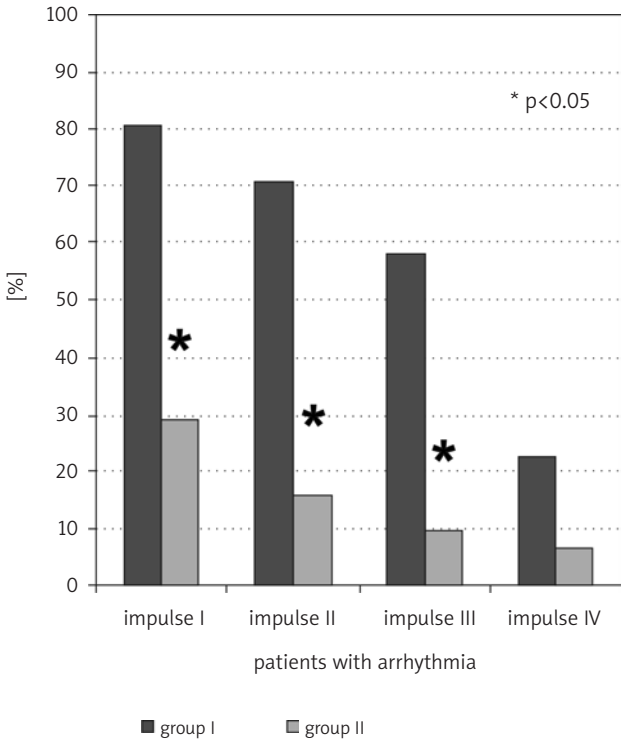

Fig. 1. Patients remaining in cardiac arrhythmia after consecutive electrical impulses

Tab. III. Maximal motor response to EC

Maximal motor response to consecutive electrical impulses	Group I (n=31)	Group II (n=19)
I degree	5 (16%)	*11 (58%)
II degree	14 (45%)	8 (42%)
III degree	8 (26%)	0 (0%)
IV degree	4 (13%)	0 (0%)
V degree	0 (0%)	0 (0%)

Tab. IV. Frequency of side-effects

Side-effects	Group I (n=31)	Group II (n=19)
pain on injection	2 (6.5%)	2 (10.5%)
nausea	0 (0.0%)	1 (5.3%)
muscle tremor	4 (12.9%)	1 (5.3%)
apnoea	0 (0.0%)	*3 (15.8%)

**p<0.05*

Mean use of propofol was higher in younger patients – the dose required to provide anaesthesia was 1.81±0.51 mg/kg in group I and 1.49±0.46 mg/kg in group II (p=0.026).

We also studied the efficacy of consecutive electrical shocks delivered to the patients and the overall efficacy of the EC. Significant differences were found between the groups. Mean amount of electrical impulses to regain sinus rhythm was 3.0±1.2 impulses in the younger group and 1.9±1.1 impulses in the older group (p<0.01). Mean total electrical energy delivered was 681±371 J for the younger group and 346±347 J for the older group (p<0.01). Overall, EC was successful in 24 patients (77%) in the younger group and in 17 patients (89%) in the older group (p=NS) (Fig. 1). Maximal motor response to consecutive electrical impulses was significantly less pronounced in older patients despite the fact that a lower dose of propofol (in mg/kg) was used. None of the patients woke up as a result of EC (Tab. III).

The frequency of side-effects was not statistically different between groups apart from more incidents of apnoea among older patients. Other side-effects analyzed included pain on injection, muscle tremor during anaesthesia and nausea after awakening (Tab. IV).

No incidents of myocardial ischaemia were noted among the studied patients. In three patients in the older group apnoea was noted and temporary respiratory support was needed. None of the patients was intubated and/or mechanically ventilated. A low dose of midazolam (2.5 mg) was given to reduce severe involuntary muscle movements and muscle tremor in one patient from the younger group.

Discussion

Propofol is probably the most popular agent for EC [1], but anaesthesia for this procedure is provided to patients in various age groups. Despite these facts, there is currently no study in the literature directly comparing the course of short-term propofol anaesthesia in younger and older patients for this popular, but somewhat specific procedure.

A few data on this subject could be found only in one study published many years ago (1991) by Lechleitner et al., where the investigators decided to isolate a subgroup of younger and older patients among patients anaesthetized with plain propofol for EC, but they compared only haemodynamic parameters [4].

Age of 65 years is usually recognized as a cut-off point for increased risk of anaesthesia and surgery. In our study, 38% of patients scheduled for elective EC were in this high-risk group. This is probably a general tendency, as patients were qualified consecutively for the study with only few exceptions (unstable angina, severe circulatory insufficiency, cardiogenic shock).

The methodology used in our study has not been found anywhere in the available literature, but we demonstrated that our anaesthesia protocol is safe and may be widely recommended. Propofol was used very carefully, the dose was rather low, and as a result we achieved a high level of haemodynamic stability. It has already been indicated that titration of drugs results in better haemodynamic stability and decreases the total dose of the drugs that are given to the patient during anaesthesia [5].

Our intention was to perform the study using observational methods available in our routine clinical practice, so we did not apply modern methods of invasive haemodynamic monitoring. Traditional, old-fashioned monitoring of vital

signs served as a useful tool in the clinical assessment of our patients.

Decrease of blood pressure values in our study was almost negligible – it decreased by a mean of 9 mmHg. This is similar to the results obtained by Lechleitner et al., who also titrated propofol for EC and observed a decrease in blood pressure values only by 2% on average [6]. It has even been confirmed that the speed of injection of intravenous anaesthetics may influence haemodynamic response. Billotta et al. injected 2.5 mg/kg propofol with the rate of 2 mg/second and 10 mg/second and found that a higher rate of injection was associated with marked decrease of arterial pressure [7].

In our study no differences were found in the efficacy of EC. Why did we think this issue may be important? In the literature one may find few anecdotal reports suggesting that the use of a general anaesthetic agent alone may terminate cardiac arrhythmia even without EC [8, 9]. We therefore decided to find out whether the efficacy of EC is different in older and younger patients. We also tried to measure the motor response to a strong and relatively standardized stimulus that takes place during EC. Our data suggest that a higher dose of propofol is needed in younger patients and despite that a significant motor response may be anticipated. No similar data have been found in the literature, so a proposed simple scale to measure motor response may be recommended to further researchers in this area.

In summary, we were able to confirm that propofol as a sole agent is safe for EC for patients in various age groups. Apnoea and mild desaturation are more frequent in older patients, whereas younger patients may present more pronounced motor response and require a higher dose of the hypnotic agent. Anaesthetic management with titrated administration of propofol is safe and may be recommended for EC, particularly in older patients.

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