

Pulmonary Vein Isolation: Patient Experience under Conscious Sedation versus Anaesthesia

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Abstract

Aim

Radiofrequency pulmonary vein isolation is an established treatment for atrial fibrillation. Patients are administered either conscious sedation or general anaesthesia. The purpose of this study was to compare patient experiences of conscious sedation versus general anaesthesia during pulmonary vein isolation.

Methods

A retrospective, observational, single-centre, single-operator study was performed, comparing patient experiences of pulmonary vein isolation performed under general anaesthesia versus conscious sedation. A Likert scale questionnaire was used to compare satisfaction with the different modes of anaesthesia, with score of 1 denoted for very dissatisfied and score of 5 for very satisfied.

Results

41 patients were included – 20 (48.8%) in conscious sedation group, and 21 (51.2%) in general anaesthesia group. Groups were well-matched as regards age (mean 56.3 +/-13.7yrs), gender (71.4% male), percentage with paroxysmal atrial fibrillation (76.2%), and percentage re-do cases (28.6%). Patients in the general anaesthesia group experienced lower levels of pain/discomfort (mean score 2.90 +/- 1.77 vs 1.33+/-0.80) ($p<0.001$) and were more likely to recommend the mode of anaesthesia (mean score 4.90 +/- 0.44 vs. 3.40 +/- 1.70) ($p<0.001$), compared with those in conscious sedation group. There was no significant difference in anxiety/depression post-procedure ($p= 0.057$), satisfaction with recovery time post-procedure ($p=0.175$), likelihood to recommend the procedure ($p= 0.103$), and overall satisfaction with the ablation experience ($p=0.089$).

Discussion

Patients who had general anaesthesia for radiofrequency pulmonary vein isolation experienced less peri-procedural pain than patients who had conscious sedation and were more likely to recommend general anaesthesia as a mode of anaesthesia.

Introduction

Pulmonary Vein Isolation (PVI) via percutaneous catheter ablation has become a cornerstone of treatment for symptomatic atrial fibrillation (AF) since the recognition of pulmonary vein triggers for AF episodes^{1, 2}. PVI is now considered as a first-line treatment in all patients with paroxysmal and many with persistent AF³. The number of PVI procedures performed has been increasing in recent years⁴.

During the PVI procedure, patients are routinely administered either Conscious Sedation (CS) or General Anaesthesia (GA)⁵. CS, also known as moderate sedation, has been defined by British Journal of Anaesthesia as a “drug-induced state where a purposeful response to verbal commands either alone or accompanied by light tactile stimulation is maintained”⁶. The purpose of procedural anaesthesia is twofold. Firstly, the analgesic properties of anaesthesia are beneficial given the recognised potential for pain during both femoral cannulation and radiofrequency catheter ablation⁷. Secondly, anaesthesia is given in an effort to minimise patient movement. Minimal patient movement is desired in order to reduce the risk of procedural complications, reduce shifts in the electroanatomic map and to enhance catheter stability⁸.

There is a paucity of literature to date on patient-reported experiences of different modes of anaesthesia used for radiofrequency PVI. We conducted this study with the aim of comparing patient experience with CS and GA during RF-PVI.

Methods

This was a retrospective, observational, single-centre, single-operator study comparing patient experiences and satisfaction with PVI performed under different modes of anaesthesia. The study was granted ethical approval by the Clinical Research and Ethics Committee of the Cork Teaching Hospitals, Ireland and the study was performed in accordance with the ethical standards as outlined in the 1964 Declaration of Helsinki.

Patients undergoing RF PVI performed by a single operator at a regional cardiac ablation centre between April 2023 and June 2024 were screened for inclusion in this study. All participants who provided informed consent and completed the questionnaire were included.

A standard approach was taken for each case. Intra-cardiac echocardiography (ICE) guided trans-septal puncture was performed. Left atrial electro-anatomical mapping was performed using a multipolar catheter and the *Carto 3 System* (Biosense Webster, Irvine, California, USA). RF ablation was performed, with point-by-point wide circumferential isolation of ipsilateral sets of pulmonary veins using an irrigated contact-force sensing ablation catheter, with 30-40W energy. Ablation Index value of 500 was targeted anteriorly and 350 posteriorly. The endpoint was electrical isolation of all pulmonary veins, which was demonstrated with entry and exit block. Patients were admitted to hospital overnight for observation and followed standard post-procedural anticoagulation protocol. The procedural time recorded was from femoral cannulation to decannulation and did not include the time taken to administer anaesthesia pre- and post-procedure.

Either CS or GA were used for each case. The mode of anaesthesia for each patient was determined by anaesthetist availability on the day of the procedure. The CS protocol consisted of 2mg intravenous midazolam and 50mcg intravenous fentanyl, administered prior to initial femoral cannulation and repeated as required throughout the procedure based on patient comfort and non-invasive vital signs. CS was prescribed by the consultant electrophysiologist performing the procedure and administered by nursing staff. Continuous peripheral oxygen saturations and intermittent non-invasive blood pressure were monitored.

The GA protocol involved induction with intravenous propofol, fentanyl and rocuronium followed by maintenance anaesthesia with either sevoflurane or continuous propofol infusion with Bispectral Index monitoring⁹, with phenylephrine for blood pressure support if required. All patients underwent tracheal intubation, and their lungs were mechanically ventilated. Vitals were otherwise also monitored non-invasively. GA was administered by a senior anaesthesiologist.

Participants were contacted by telephone 3-9 months post-procedure and asked to answer a Likert-scale questionnaire based off the Euro-Qol 5D validated survey tool in order to evaluate their respective procedural experiences (appendix 1) in six domains: (1) Pain/discomfort during procedure, (2) anxiety/depression post-procedure, (3) satisfaction with recovery time post-procedure, (4) likelihood to recommend procedure, (5) likelihood to recommend mode of anaesthesia, (6) overall satisfaction with ablation experience^{10, 11}.

Baseline patient demographics and basic clinical information were collected from electronic patient records and procedural reports. Procedural complications and procedural time were gathered from the procedural reports.

Data analysis was performed with *IBM SPSS Statistics*, version 24 (SPSS, Inc., Chicago, Illinois, USA). Baseline characteristics were presented as means with standard deviations, or percentages. Categorical data were collated between groups with Pearson Chi-square tests

and continuous data with paired T-test of means for normally distributed data. P-value of <0.05 was considered to be statistically significant.

Results

Patient characteristics

Attempts to contact patient and complete questionnaire were successful in 41 of the 63 patients screened for inclusion: 20 patients in CS arm, and 21 in GA arm. Both CS and GA groups had similar baseline demographic and clinical characteristics (Table 1).

	GA (n=21)	CS (n=20)	Statistical significance
Mean age (years) (+/- SD)	56.3(+/-13.7)	59.1(+/- 9.8)	0.22
% Males	71.4%	70%	0.460
% Paroxysmal atrial fibrillation	76.2%	60%	0.265
% Re-do PVI	28.6%	20%	0.408

Table 1: Baseline demographic and clinical characteristics of GA (General Anaesthesia) and CS (Conscious Sedation) groups

Patient satisfaction

The level of pain/discomfort reported by patients in both cohorts is displayed in Figure 1. The mean pain/discomfort was 2.90 +/- 1.77 in CS arm versus 1.33 +/- 0.80 in GA arm ($p < 0.001$), with a score of 1 representing 'no pain/discomfort' and 5 representing 'maximum pain/discomfort'.

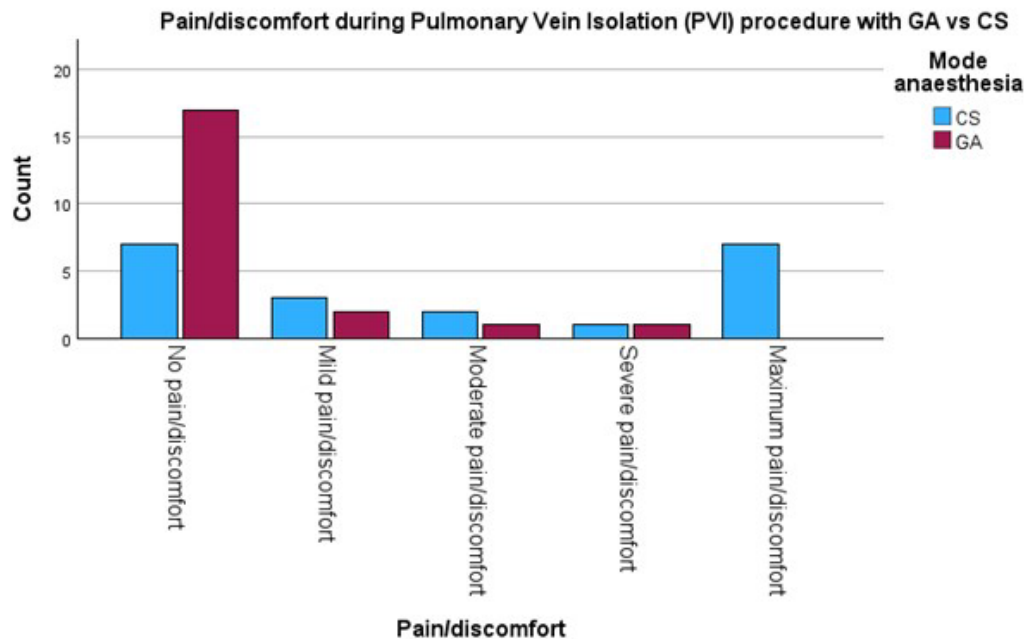


Figure 1: Bar chart representing patient-reported pain/discomfort during PVI procedure with GA (General Anaesthesia) vs CS (Conscious Sedation)

There was low overall self-reported anxiety/depression post-procedure at 1.32 out of 5 (with 1 representing no anxiety/depression and 5 representing maximum anxiety/depression) with no statistically significant differences in scores between GA (1.05 +/- 0.05) and CS (1.60 +/- 0.28) groups ($p=0.057$).

There was no significant difference between GA and CS groups regarding likelihood to recommend PVI procedure with 92.7% of patients overall 'very likely' to recommend it to another in need ($p=0.103$).

There was no significant difference between GA and CS groups as regards satisfaction with recovery time post-procedure ($p=0.175$), with 85.3% of patients overall being either 'satisfied' or 'very satisfied' with their recovery time.

There was a noticeable difference between CS and GA groups regarding the likelihood to recommend the mode of anaesthesia, with patients significantly more likely to recommend GA rather than CS (Figure 2). The mean score in GA group was 4.90 +/- 0.436 versus mean score 3.40 +/- 1.70 in CS group, with 5 representing 'very likely to recommend mode of anaesthesia' and 1 representing 'very unlikely to recommend mode of anaesthesia' ($p<0.001$).

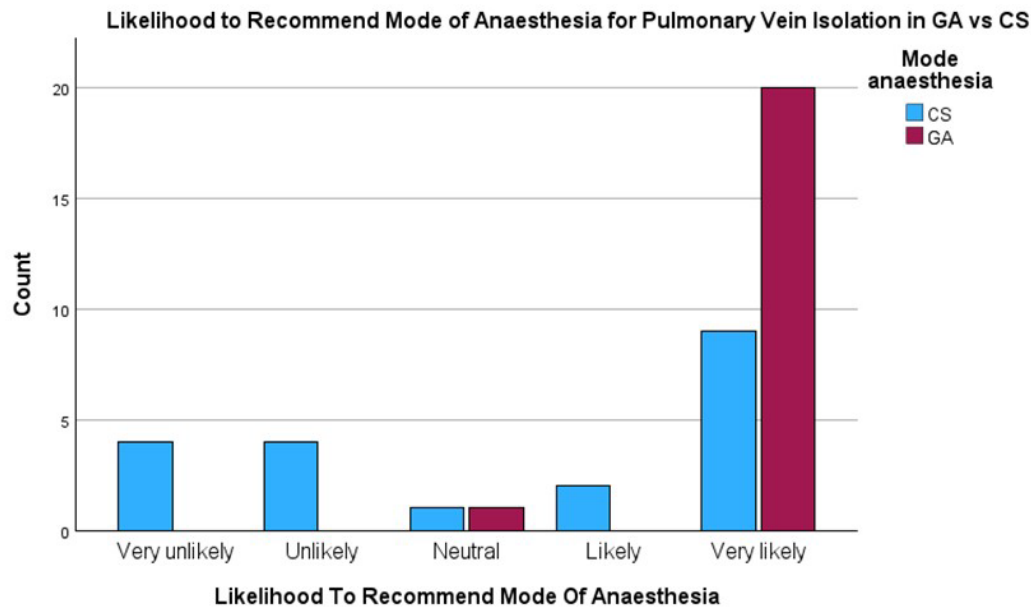


Figure 2: Bar Chart representing patient-reported Likelihood to Recommend mode of anaesthesia for Pulmonary Vein Isolation (CS = Conscious Sedation, GA = General Anaesthesia)

There was no significant difference in overall satisfaction with the ablation experience as displayed in Figure 3 ($p=0.089$).

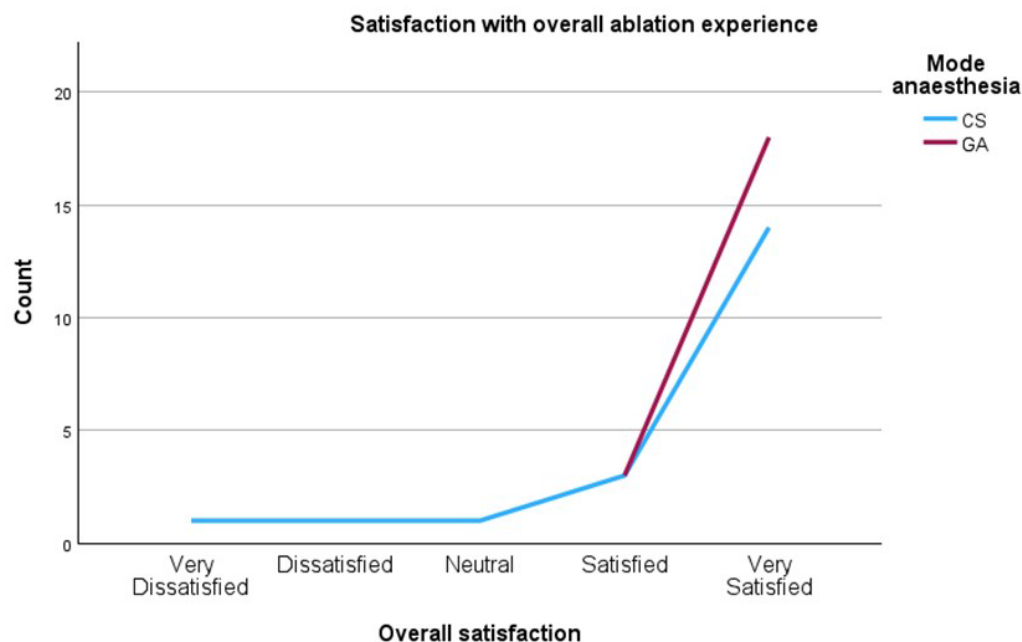


Figure 3: Line graph representing satisfaction with the overall ablation experience (CS = Conscious Sedation, GA = General Anaesthesia)

Procedural statistics

Mean total procedure duration was 119.7 (+/- 34.9) minutes in CS arm versus 75.5 (+/- 17.3) minutes in GA arm ($p<.001$). There were no procedural or anaesthetic-related serious adverse events reported in either group.

Discussion

Our observational study looking at patient-reported experiences with GA versus CS for RF PVI found that GA reduces procedural pain/discomfort when compared to CS. Patients were also more likely to recommend GA over CS for PVI. Although no definitive conclusions can be drawn, the results also suggest a potential trend toward reduced anxiety and depression with the use of GA. Further studies with larger sample sizes are needed to better understand and clarify this relationship.

Most research to date comparing the efficacy of modes of anaesthesia for PVI focus on procedural success as measured by atrial fibrillation recurrence at a set timepoint post-procedure. More recently, the research focus has also expanded to include real-time indices of technical procedure success such as catheter stability or reaching pre-defined Ablation Index targets¹². Although earlier results were conflicting, the latest research supports the concepts of both improved catheter stability^{13, 14} and reduced likelihood of recurrent atrial fibrillation symptoms with use of GA when compared to CS¹⁵. Our study adds to the evidence in support of using GA for PVI from a different, but important perspective. It is interesting that there was no difference detected between the groups in overall satisfaction with the ablation experience, with the overall positive results in both groups in keeping with previous findings¹⁶. We suspect this may be due to the retrospectively appreciated differences in pain/discomfort being superseded by the patients' overall satisfaction with relief of atrial fibrillation symptoms. Wasserlauf *et al* also found no significant difference in patient-reported outcomes between GA and 'moderate sedation' for PVI, however this study included cryoballoon rather than RF-PVI¹⁷.

Average procedural time was considerably lower with use of GA when compared to CS. This is in keeping with a number of previous observational studies, although other studies have had contradictory findings with only reductions in ablation time^{18, 19}. Whilst perhaps multifactorial, ongoing research suggesting improved catheter stability with GA versus CS, could theoretically explain this time difference¹³.

When contemplating which mode of anaesthesia to use for PVI, the likelihood of technical procedural success must be balanced with the patient's wishes, as well as their suitability for different types of anaesthesia. On the one hand, CS may be viewed as more cost-effective, efficient and practical as it obviates the need for an anaesthetist and expensive ventilation equipment^{20, 21}. However, there is a delicate balance with CS between ensuring adequate patient comfort and avoiding the adverse effects of over-sedation such as apnoea, airway obstruction, hypoventilation and hypotension²². Some of these adverse effects may be avoided with GA.

Unfortunately, patient preference and clinical efficacy are not the only things that must be considered. The mode of anaesthesia chosen for pulmonary vein isolation procedures is oftentimes dictated by resource availability. CS, usually in the form of bolus administration of low dose intravenous benzodiazepine and short-acting opioid, is usually administered by the nursing staff as directed by the electrophysiologist who is performing the procedure. This differs from the GA approach which necessitates having an anaesthetist present for the duration of the procedure. Although the involvement of an additional consultant anaesthetist increases the overall cost of the procedure, it appears to improve efficiency in the Electrophysiology Laboratory by enabling the operator to focus exclusively on ablation, thereby reducing procedure time and supporting a greater procedural volume.

We believe this information adds to the body of evidence in support of using GA for RF-PVI, which is important when allocating resources and planning the delivery of an ablation service. It is reassuring that the increasing use of GA over CS for PVI worldwide in recent years appears to be more favourable from a patient perspective²³.

We must acknowledge that the sample size in this study was relatively small, and larger studies are needed to draw definitive conclusions. In addition, we did not collect data on the total time in Electrophysiology laboratory, taking into account total anaesthesia time which is important to consider in resource-limited institutions. We must also state the potential for selection bias given the number of non-responders.

In this single-centre single-operator observational study assessing patient experience of RF-PVI under different modes of anaesthesia, we found that General Anaesthesia was associated with a more comfortable and acceptable patient experience than Conscious Sedation. This has important implications for planning service delivery in centres performing AF ablation in an era of increasing need and demand for AF ablation.

Declarations of Conflicts of Interest:

None declared.

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Appendix 1

Regarding your recent Pulmonary Vein Isolation catheter ablation procedure for atrial fibrillation, please give the one most appropriate answer for each question below.

Question 1 – How would you rate the pain/discomfort you experienced around the time of your procedure?

- 1 No pain/discomfort
- 2 Mild pain/discomfort
- 3 Moderate Pain/discomfort
- 4 Severe pain/discomfort
- 5 Maximum pain/discomfort

Question 2 – How would you rate any anxiety/depression you experienced post-procedure?

- 1 No anxiety/depression
- 2 Mild anxiety/depression
- 3 Moderate anxiety/depression
- 4 Severe anxiety/depression
- 5 Maximum anxiety/depression

Question 3 – How satisfied were you with your recovery time post procedure?

- 1 Very dissatisfied

2 Dissatisfied

3 Neutral

4 Satisfied

5 Very satisfied

Question 4 – How likely are you to recommend this procedure?

1 Very unlikely

2 Unlikely

3 Neutral

4 Likely

5 Very likely

Question 5 – How likely are you to recommend the type of sedation you received?

1 Very unlikely

2 Unlikely

3 Neutral

4 Likely

5 Very likely

Question 6 – How satisfied were you with the overall ablation experience including the procedure itself and the sedation you received?

1 Very dissatisfied

2 Dissatisfied

3 Neutral

4 Satisfied

5 Very satisfied