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Clement Batteux,[a,b] Vlad Ciobotaru,[a,c] Hélène Bouvaist,[d] Aleksander Kempny,[e] Alain Fraisse,[e] and Sebastien Hascoet[a,b,e,*]

[a]*Hopital Marie Lannelongue, centre de reference reseau maladies rares M3C, Groupe Hospitalier Paris Saint Joseph, Universite Paris-Saclay, BME Lab, Le Plessis-Robinson, France*
[b]*Institut national de la santé et de la recherche médicale (INSERM), Unite Mixte de Recherche UMR S-999, Universite Paris-Saclay, Le Plessis-Robinson, France*
[c]*Clinique Franciscaines, 3Dheartmodeling, Nîmes, France*
[d]*Centre Hospitalier Universitaire de Grenoble, France*
[e]*Royal Brompton Hospital, London, United Kingdom*

* Corresponding author.
E-mail address: s.hascoet@ghpsj.fr (S. Hascoet).

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Safety and efficacy of a sedation protocol combined with propofol as the second step in transesophageal echocardiography

Eficacia y seguridad de un protocolo de sedación combinado con propofol como segundo escalón para el ecocardiograma transesofágico

To the Editor,

Transesophageal echocardiography (TEE) causes nausea, pain, and anxiety and must be performed under sedation and analgesia. The American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists recommend a number of drugs for this purpose (topical anesthesia, benzodiazepines, opioids, and, with a narrower safety profile, propofol), but they do not specify doses, combinations, or order of administration.[1] Midazolam is recommended as the drug of choice by the European Association of Cardiovascular Imaging, which proposes fentanyl as an alternative but does not mention propofol.[2] Spanish law does not dictate which physicians are allowed to use propofol. This drug is widely used to induce anesthesia during procedures requiring deep sedation, but its use has spread to TEE, where it is sometimes administered by cardiologists. A study comparing anesthesiologist-administered propofol, midazolam, and midazolam-alfentanil during TEE found that propofol produced deeper, more rapid sedation without major complications.[3] Another study comparing propofol administered by anesthesiologists and nonanesthesiologists during TEE found that mild respiratory complications were more common in the first group because the patients had a higher risk profile.[4] Propofol has also been shown to be an effective sedation agent in a clinical trial setting.[5]

We describe our experience with a sedation and analgesia protocol that includes propofol as a second option when adequate sedation is not achieved with midazolam and pethidine. The anesthesia department at our hospital is familiar with and has endorsed the use of this protocol.

We prospectively included all patients who underwent TEE from May 2020 to April 2021. The study was approved by the local ethics committee. A 10-item safety checklist was administered before each procedure, and propofol was not allowed in patients allergic to peanuts, soy, or eggs. Four expert echocardiographers performed the procedures in a room with cardiopulmonary resuscitation equipment. All patients received oxygen via a nasal cannula (3 L/min) and were administered topical lidocaine at the discretion of the echocardiographer. The protocol is shown in figure 1. Frail patients and patients with a high American Society of Anesthesiologists score were administered half a dose of pethidine (25 mg) or none. Following TEE examination, patients were transferred to the recovery room and their intravenous access maintained until they regained consciousness and their vital signs were stable.

Blood pressure, heart rate, oxygen saturation, and sedation level (Ramsay scale) were recorded at baseline and every 3 minutes. Sedation time was defined as the time from sedation initiation to probe withdrawal and recovery time as the time from probe withdrawal to discharge from the recovery room. Before leaving the hospital, patients completed a questionnaire in which they were asked to rate the following: *a*) their perceived level of sedation on a 10-point visual analog scale (VAS), where 10 represented ideal sedation, and *b*) level of discomfort or pain,

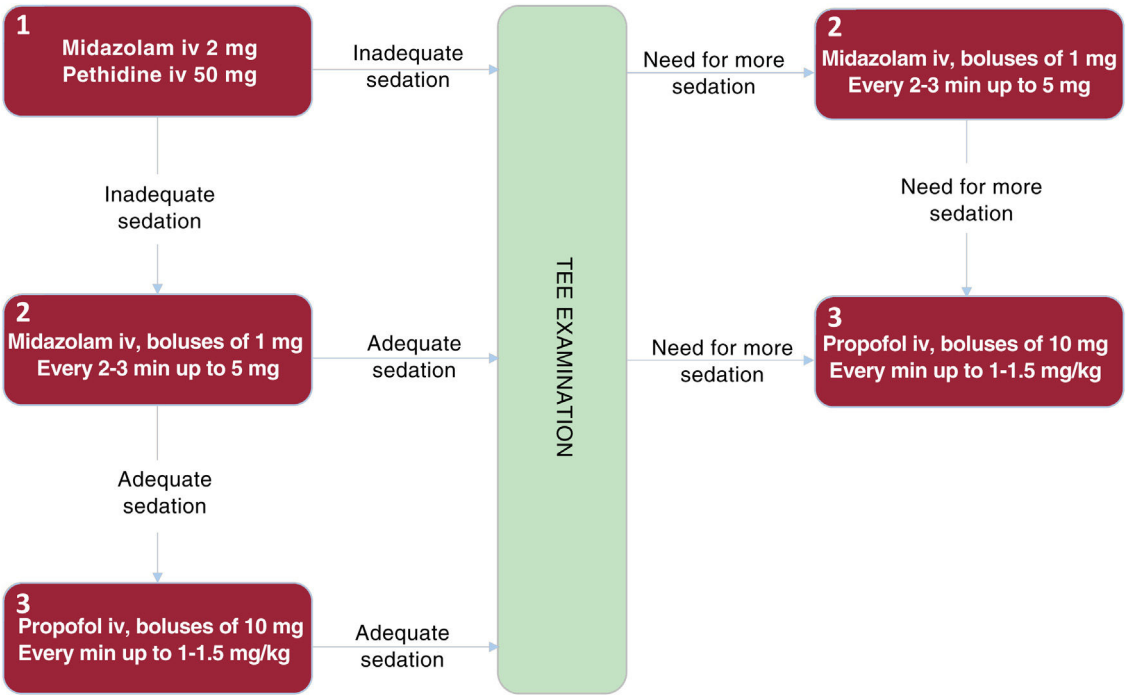

Figure 1. Sedation protocol. IV, intravenous; TEE, transesophageal echocardiography.

Table 1
Baseline patient characteristics, procedure times, sedation- and procedure-related complications, and patient and cardiologist satisfaction

	All procedures (n = 286)	Procedures without propofol (n = 232)	Procedures with propofol (n = 54)	*P*
Age, y[a]	66 [53.75-75]	68 [55.25-76]	57.50 [42.75-64.25]	< .001[b]
Male sex[c]	175 (61.2)	133 (57.3)	42 (77.8)	.005[b]
Body surface area[a]	1.90 (0.2)	1.89 (0.2)	1.95 (0.19)	.056
Body mass index[a]	27.55 [24.5-31.15]	27.74 [24.35-30.98]	26.83 [24.69-31.83]	.98
Patient[c]				
Outpatient	171 (59.8)	129 (55.6)	42 (77.8)	.003[b]
Hospitalized	115 (40.2)	103(44.4)	12 (22.2)	
Atrial fibrillation/flutter[c]	83 (29)	71 (30.6)	12 (22.2)	.222
Diabetes mellitus[c]	71 (24.8)	70 (30.2)	1 (1.9)	< .001[b]
Hypertension[c]	180 (62.9)	150 (64.7)	30 (55.6)	.212
Dyslipidemia[c]	124 (43.4)	106 (45.7)	18 (33.3)	.099
COPD[c]	19 (6.6)	16 (6.9)	3 (5.6)	.716
Obesity[c]	87 (30.4)	72 (31.0)	15 (27.8)	.639
Liver disease[c]	7 (2.4)	5 (2.1)	2 (3.7)	.529
Alcohol[c]	26 (9.1)	16 (6.9)	10 (18.5)	.014[b]
Creatinine[a]	0.95 [0.79-1.15]	0.96 [0.8-1.19]	0.90 [0.74-1.05]	.092
LVEF > 50%[c]	222 (77.6)	176 (75.9)	46 (85.2)	.139
ASA score[c]				
≤ 2	48 (16.8)	31 (13.3)	17 (31.5)	.001[b]
> 2	238 (83.2)	201 (86.7)	37 (68.5)	
Times				
Sedation time[a]	20.38 [16.26-25.24]	20.34 [16.17-24.52]	20.53 [16.77-27.16]	.235
Recovery time[a]	31.66 (16-46)	29.87 (14.81-45.81)	33.30 (21.00-46.41)	.104
Drugs				
Lidocaine	56 (19.6)	49 (21.1)	7 (13)	.174
Flumazenil	22 (7.7)	18 (7.8)	4 (7.4)	1.000
Sedation-related complications				
Mild hypoxemia ($SatO_2$, 81%-89%)[c]	15 (5.2)	12 (5.2)	3 (5.6)	1.000
Mild hypotension (SBP < 90 mmHg for > 3 min[c]	39 (13.6)	29 (12.5)	10 (18.5)	.246

Table 1 *(Continued)*
Baseline patient characteristics, procedure times, sedation- and procedure-related complications, and patient and cardiologist satisfaction

	All procedures (n = 286)	Procedures without propofol (n = 232)	Procedures with propofol (n = 54)	*P*
Bradycardia[c]	2 (0.7)	2 (0.9)	0 (0.0)	1.000
Procedure-related complications				
Cough[c]	30 (10.5)	20 (8.6)	10 (18.5)	.033[b]
Nausea[c]	30 (10.5)	15 (6.5)	15 (27.8)	< .001[b]
Moderate bleeding[c]	3 (1)	2 (0.9)	1 (1.9)	.468
Esophageal tear[c]	1 (0.3)	1 (0.3)	0 (0)	-
Patient satisfaction				
Level of sedation[c]				
< 8	16 (5.7)	15 (6.5)	1 (1.9)	.129
≥ 8	266 (94.3)	213 (91.8)	53 (98.1)	
Would recommend[c]	278 (97.2)	224 (96.6)	54 (100)	.19
Would choose again[c]	278 (97.2)	224 (96.6)	54 (100)	.19
Pain[b]	35 (12.2)	28 (12.1)	7 (12.9)	.891
Cardiologist satisfaction				
TEE procedure[c]				
< 8	35 (12.2)	23 (9.9)	12 (22.2)	.013[b]
≥ 8	251 (87.8)	209 (90.1)	42 (77.8)	
Image capture[c]				
< 8	37 (12.9)	21 (9.1)	16 (29.7)	< .001[b]
≥ 8	249 (87.1)	211 (90.9)	38 (70.3)	
Would recommend[c]	282 (98.6)	229 (98.7)	53 (98.1)	.761
Would accept[c]	281 (98.3)	229 (98.7)	52 (96.3)	.269

Abbreviations: ASA, American Society of Anesthesiologists; COPD, chronic obstructive pulmonary disease; LVEF, left ventricular ejection fraction; $SatO_2$, oxygen saturation; TEE, transesophageal echocardiography.
[a] Based on Mann-Whitney U test.
[b] $P < .05$.
[c] Based on chi-square test.
[d] *P*: comparison of procedures with and without propofol.
Values are expressed as No. (%), mean ± standard deviation, or median [interquartile range].

where a VAS score of 10 represented the worst possible pain. They were also asked if they would choose the same sedation if they had to repeat the examination and if they would recommend it to another patient. Cardiologists, also scoring from 0 to 10, rated their satisfaction with the sedation regimen in terms of the TEE procedure and ease of image acquisition. They were also asked if they would recommend the regimen and use it again in future TEE examinations.

In total, 286 TEE procedures were performed in 286 patients. Fifty-six patients (19.6%) were administered topical lidocaine. They all received midazolam at a median dose of 3 mg [interquartile range, 2.75-4 mg]. Pethidine was administered at a dose of 50 mg to 259 patients (90.6%) and 25 mg to 23 (8%). Four patients (1.4%) did not receive this drug. Propofol at a median dose of 20 mg [10-30 mg] was administered to 54 patients (18.9%). It was prepared in a 10-mL syringe (10 mg propofol/mL) and administered in boluses of 1 mL. The reason for its use in all cases was insufficient sedation. There were no paradoxical reactions to midazolam. Eleven of the 54 patients (20.37%) were administered propofol before intubation. Flumazenil was used in 22 of the 286 procedures (7.7%). Naloxone was not used. None of the patients required ventilation with a manual resuscitator or intervention by the anesthesiologist. Baseline clinical characteristics, sedation and recovery times, complications, and patient and cardiologist satisfaction scores are shown in table 1 for the procedures as a whole and according to whether propofol was used or not.

Patients administered propofol were significantly younger and more likely to be male, to have been admitted on an outpatient basis, to consume alcohol, and to have an ASA score of 2 or lower. There were no differences in complications between the propofol and nonpropofol groups, although patients in the former had a higher frequency of cough and nausea. Cardiologist satisfaction with the TEE examination and image acquisition was lower in the propofol group, probably because of the greater difficulty in attaining adequate sedation, as reflected by the higher rates of cough and nausea. There were no differences between the groups in terms of patient satisfaction with level of sedation and comfort.

Our findings show that adding propofol to achieve adequate sedation in imaging units when midazolam and pethidine are insufficient is safe and does not affect patient satisfaction. Our findings are limited because we analyzed a small number of cases in a nontrial setting. Multicenter trials with larger samples would be helpful for comparing different sedation regimens.

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AUTHORS' CONTRIBUTIONS

I. Paneque and J. López-Haldón: design, analysis, and writing of manuscript. N. Galán-Páez, M.R. Camacho-Fernández de Líger, C. Lao-Peña, and A. Aguilera-Saborido: data collection and manuscript review.

CONFLICTS OF INTEREST

None.

Inmaculada Paneque,[a,b] Nuria Galán-Páez,[a] María Rocío Camacho-Fernández de Líger,[a] Carolina Lao-Peña,[a] Almudena Aguilera-Saborido,[a] and José López-Haldón[a,*]

[a]*Servicio de Cardiología, Hospital Universitario Virgen del Rocío, Seville, Spain*
[b]*Facultad de Enfermería, Universidad de Sevilla, Seville, Spain*

* Corresponding author.
E-mail addresses: josee.lopez.sspa@juntadeandalucia.es, jelhaldon@gmail.com (J. López-Haldón).

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Employment situation of young cardiologists in Spain

Situación laboral de los jóvenes cardiólogos en España

To the Editor,

The population distribution in cardiologists is broader than in other specialties, with significant numbers of young professionals (39% aged $\leq$ 40 years) and a small percentage close to retirement (12% aged $\geq$ 60 years),[1] a trend likely to persist due to the increased number of positions for cardiology residents (26% added in the past 8 years). The current supply and demand for cardiologists is considered balanced, and no increases in the need for specialists are expected in the next 10 years (some mathematical models project a slight-to-moderate surplus).[1] There has also been an increase in temporary (91% of contracts in 2017)[1]and part-time contracts (particularly in the private sector) and a growing trend toward subspecialization.

Several studies have investigated the employment situation in other countries,[2,3] but the situation of young cardiologists specifically in Spain is unknown. Consequently, the Young Cardiologists group of the Spanish Society of Cardiology (SEC) carried out an online, self-administered, voluntary and anonymous 40-item survey among SEC members aged $\leq$ 40 years (with comparisons to avoid any skewing or duplicates) in 2 stages (September 2021 and January-February 2022).

A total of 1124 members were contacted, with responses from 334 (30%) individuals (age, 35.8 $\pm$ 4.1 years; 54% women). Further postresidency subspecialty training had been undertaken by 67% (figure 1A), 88% of them in Spain, with fellowships of 1 to 2 years (figure 1B). A total of 86% received financial compensation during the training (figure 1C). Among these, only 11% received wages similar to those established for attending specialists (> €36 000 in gross pay per year), 9% were paid less than the minimum wage (< €12 000 per year; 18% of all men and 28% of all women; P = .08), and 14% received no compensation (10% of all men and 19% of all women; P = .07). Compensation consisted mainly of grants (44%) or contracts from research foundations or institutions (21%) (figure 2D). Among these employees, 64% combined this with other paid work. This was true of 70% of all those earning yearly gross pay lower than €24 000 vs 42.5% of all those earning more; P = .001. Nevertheless, 55% were dissatisfied with the training received (63% of all women vs 46% of all men; P = .013; 58% of those trained in Spain vs 28% of those studying abroad; P = .004). On multivariate analysis, dissatisfaction was associated with low compensation (67% of all those earning yearly gross pay lower than €24 000 vs 15% of all those earning more; P < .0001), with other paid work (65% yes vs 37% no; P< .001), and with the need to postpone a life goal (61% yes vs 35% no; P = .002).

In the early years of their employment, 91% found work upon finishing residency, and temporary contracts were the norm, with only 10% holding an attending position (interim or permanent) (figure 2A). The first contract lasted an average of 7 [interquartile range, 3-15] months (figure 2B). A total of 9% took a median of 1 [1-2] month to find employment. In addition, most contracts (52%) were in the form of grants or research intensification (subsidies aiming to hire physicians to perform the clinical activity of principal investigators), on-duty, or locum physician contracts. Among the people surveyed with work experience $\geq$ 2 years, 64% reported that they had had a short-term employment contract at some point, 41% had had a locum physician contract, 25% had an on-duty contract, and 37% had been unemployed.

The survey showed that 76% of participants only provided patient care, 14% combined it with research, 4% combined it with teaching duties, and 3% devoted time to all 3. In total, 43% worked in a different location from where they were trained (93% of them in a different autonomous community and 7% in another country). In terms of patient care, 67% worked only in the Spanish National Health System, 4% only in private health, and 29% in both. The most common gross yearly salary was €45 000 to €60 000 in the public sector (34%), < €15 000 in the private sector (43%) (figure 2C), and €45 000 to €60 000 (67%) for those working only in the private sector. A total of 82% reported working on-duty shifts either 3 to 4 times (44%) or 1 to 2 times per month (42%). In terms of contracts, temporary contracts continued to predominate (figure 2D), although a greater percentage held more stable employment (39.4% had interim or permanent positions). While 46% stated that they had taken the competitive examination of the Spanish public employment offer (OPE) system, only 13% had obtained a position within a median of 7 [4-9] years after residency.

Nevertheless, 82% of participants reported job insecurity after residency, 59% defined their current status as unstable, and 73% considered their compensation to be below desirable levels. Additionally, 73% felt the need to postpone a life goal (80% of women vs 66% of men; P = .006), and 62% considered emigrating to improve their conditions (69% of men vs 55% of women; P = .015). The proposals seen as potentially most useful were more frequent