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Investigation of perfusionists' level of knowledge on the use of temporary epicardial pacemaker in adult cardiac surgery

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Abstract

Objective: The aim of this study was to evaluate the level of knowledge of perfusionists regarding the use of temporary epicardial pacemakers in adult cardiac surgery and the adequacy of their training on this subject.

Materials and methods: This cross-sectional descriptive study was conducted using an online survey among 147 perfusionists. Data were analysed using descriptive and inferential statistics.

Results: Only 8.8% of the participants had received training on the temporary epicardial pacemaker and none of them considered it sufficient. The highest knowledge was related to sinus bradycardia and indications for complete AV block. Knowledge about complications was moderate.

Conclusion: Although the role of perfusionists in temporary epicardial pacemaker applications is important, the lack of clarification of these responsibilities by institutional protocols leads to uncertainties in practice. It is necessary to establish standardised training and written guidelines for perfusionists in order to maintain the use of temporary epicardial pacemakers in a safe and effective manner.

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Introduction

Cardiac surgical operations performed using extracorporeal circulation techniques [Cardiac surgical operations performed with cardiopulmonary bypass (CPB)] remain important in the treatment of heart diseases and are often a method that has no alternative. Perfusionists play a major role in the cardiac surgery team in performing these operations. In addition, although historically the development of cardiovascular perfusion arose from the need for CPB, the development of extracorporeal support technology has recently enabled it to go beyond its traditional field. The perfusionist profession will continue to maintain its importance in the near future. Developments in science and technology will cause absolute changes in perfusionist practices. The qualification, knowledge, duties and responsibilities of the clinical perfusionist, the professional profile of perfusionists is in a clear and current evolution in terms of competence. Temporary epicardial pacemakers are often routinely used in adult patients undergoing cardiac surgery to provide haemodynamic stabilisation to combat arrhythmias (1). It is used as a necessity in the surgical repair of atrial septal defects, especially in high-risk patients. It is also often the best and sometimes the only method of treating transient rhythm disturbances.

During and after open-heart surgery, temporary epicardial pacemaker support may be needed to revitalise the heart or to regulate rhythm disturbances. Temporary epicardial pacemaker used for this purpose is frequently and routinely implanted especially in patients undergoing coronary artery bypass grafting (CABG) surgery. The temporary epicardial pacemaker allows temporary control of the electrical activity of the heart (pacing) and monitoring of the intracardiac electrocardiogram. Temporary epicardial pacemaker wires are placed on the surface of the heart during surgery and act as an electrical bridge between the patient's heart and the device, allowing electrical impulses to be transmitted through an external pacemaker unit (2,3). Although decisions regarding placement of epicardial wires are made by cardiac surgeons, and much of the management and preparation of pacing systems in weaning from open-heart surgery is performed by perfusionists, it is therefore essential that perfusionists have a sound understanding of the indications for and management of temporary epicardial pacemakers.

The aim of this study was to evaluate the level of knowledge of perfusionists regarding the use of temporary epicardial pacemakers in adult cardiac surgery and to reveal their views on the adequacy of university education processes in this field. In many centres, perfusionists play an active role in the preparation and application of these devices. However, it is not clearly known to what extent perfusionists have knowledge on this subject and whether they receive adequate theoretical or practical training during their university education.

In this context, the aim of this study was to measure the level of knowledge of perfusionists about temporary epicardial pacemaker applications, to examine the relationship between demographic characteristics and knowledge levels, and to determine possible training deficiencies in university education processes. The findings to be obtained are aimed to be guiding in terms of updating perfusion education and contributing to the relevant curricula.

Material and methods

This study was conducted as a descriptive and cross-sectional study.

Ethical dimension of the research: For this study, approval was obtained from the local ethics committee (Harran University Social and Human Sciences Ethics Committee) on 16.04.2025 with session number 4 and board decision number 2025/135. Informed consent was obtained from all individuals participating in the study. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Population and sampling: The population of the study consisted of perfusionists actively working in cardiac surgery centres licensed by the Ministry of Health in Turkey. Voluntary sampling, one of the non-probability sampling methods, was used for sample selection.

Data collection tool: Data were collected with an online questionnaire form developed by the researcher. The questionnaire form was created using the Google Survey platform and sent to perfusionists electronically. In the questionnaire form, the participants were asked closed-ended questions about demographic and descriptive information, their level of knowledge about temporary epicardial pacemaker applications, and their views on university education processes on this subject. In the survey

questions, only questions related to the research topic were included. In this context, a 5-point Likert-type scale (I don't know at all - I know very well) was used to assess the level of knowledge about the indications.

Data analysis: The data obtained from the questionnaire were analysed using Microsoft Excel and SPSS® (Statistical Package for the Social Sciences) software. Frequency, percentage, mean and standard deviation were calculated as descriptive statistics. In addition, descriptive statistical analyses were used to evaluate the level of knowledge of the participants regarding the indications for temporary epicardial pacemaker and possible complications. Measures of central tendency (mean, median and mode) and variance (standard deviation) were calculated for each statement.

Results

The demographic and temporary epicardial pacemaker information of the participants are given in Tables 1 and 2.

As shown in Table 3, the topics for which the participants had the highest level of knowledge regarding temporary epicardial pacemaker indications were "Sinus Bradycardia" (Mean=3.7, SD=1.3) and "Complete atrioventricular (AV) Block" (Mean=3.6, SD=1.2). Regarding the indications for temporary epicardial pacemaker, 59% of the participants stated that they had 'Good' or 'Very Good' knowledge for 'Sinus Bradycardia'.

On the other hand, 'Working Close to the Conduction System During Surgery' stands out as an area where the participants have relatively less knowledge with the lowest mean score (Mean=2.8, SD=1.0). The rate of those who said 'I do not know at all' about this situation is remarkable with 15% and shows that this area needs to be strengthened in terms of education and awareness.

Other important clinical conditions such as "Postoperative nodal rhythm" and "Low cardiac output" were also among the topics with moderate knowledge, and in both cases, approximately 70% of the participants defined themselves as "Fair" or "Good" knowledge.

Although the topic 'Management of rhythm disturbances and haemodynamic instability that may develop in the early period after open heart surgery' is a topic of high clinical importance, only 53% of the participants stated that they knew "Well" or 'Very Well' about the indications for temporary epicardial pacemaker. This suggests that it may be beneficial to increase the theoretical and practical training in this area in perfusion education.

Table 1: Demographic data of participants (n=147)

Variables	Items	n (%)
Age (years)	Mean ± SD	32.87±7.00
	Minimum- Maximum	22 - 55
Gender	Male	92 (62.6%)
	Female	55 (37.4%)
Education status	Bachelor degree	34 (23.1%)
	Master's degree	110 (74.8%)
	Doctorate	3 (2.0%)
Perfusion authorisation certificate	Yes	8 (5.4%)
	No	139 (94.6%)
Institution	University hospital	42 (28.6%)
	State hospital	38 (25.9%)
	Private hospital	45 (30.6%)
	City / Training and research hospital	22 (15.0%)
Professional experience (years)	Mean ± SD	6.8±4.2
Number of perfusionists in the clinic	Mean ± SD	3.2±1.5
Number of perfusionists in an operation	Mean ± SD	1.4±0.6

Mean ± SD: Mean ± Standard Deviation, n: Number, %: Percentage

Table 2: Information about temporary epicardial pacemaker

Questions	Options	n (%)
Did you receive training on Temporary Epicardial Pacemaker during your education?	Yes	13 (8.8%)
	No	96 (65.3%)
	I don't remember	38 (25.9%)
If you have received training, do you find this training sufficient? (Calculated for those who answered yes)	Yes	0 (0.0%)
	No	7 (%53.8)
	Partially	6 (46.2%)
Does your clinic have a written Temporary Epicardial Pacemaker protocol?	Yes	0 (0.0%)
	No	76 (51.7%)
	I don't know	71 (48.3%)
Who performs Temporary Epicardial Pacemaker preparation/follow-up in CPB surgery?	Anaesthesia team	21 (14.3%)
	Perfusion team	78 (53.1%)
	Nursing team	42 (28.6%)
	Other	6 (4.1%)

CPB: Cardiopulmonary bypass, n: Number, %: Percentage

When the knowledge level of the participants regarding the complications that may develop due to temporary epicardial pacemaker applications was analysed, the mean score was determined as 3.1. This finding shows that the level of knowledge is generally at 'moderate' level. The fact that the median and mode values were also 3 supports that the centre of the distribution again points to the middle level. While 10% of the participants stated that they had no knowledge about complications, 22% stated that they had little knowledge. The highest percentage belongs to the participants who stated that they had 'moderate knowledge' with 38%. On the other hand, only 8 per cent considered themselves to be 'very well' informed. This shows that the level of knowledge on a vital issue such as complications is generally limited.

Discussion

Although temporary epicardial pacemaker wires are routinely implanted after cardiac surgical procedures, there is little in the medical literature to help standardise their use and identify associated risks and benefits. Most decisions regarding pacemaker wires are based on surgeon preference and vary widely between centres. Although temporary epicardial pacemaker wires play an important role in the postoperative recovery period, the available literature suggests that they should be evaluated individually in all high-risk patients, including those with increasing age, low ejection fraction, diabetes mellitus, high pulmonary artery pressures, prolonged cross-clamp time, temporary epicardial pacemaker required for weaning from CPB, preoperative arrhythmia, and multiple valve and transplant operations. Although complications from temporary epicardial pacemaker wires are low, this figure is probably underreported and further studies are needed to focus on the risks and benefits of placement (4,5). Placement of temporary epicardial pacemaker wires after CABG is a routine procedure in many centres despite rare but significant complications such as bleeding, tamponade and death (6). However, it is also reported in the literature that the frequency of temporary epicardial pacemaker wire use after CABG surgery is low (7). It should also be noted that temporary epicardial pacemaker wires are used to maintain a stable heart rhythm after cardiothoracic surgery, these should be distinguished from the more commonly encountered transvenous temporary pacemaker wires that are often used in coronary care units for the same purpose (8).

In this study, the level of knowledge of perfusionists, who are healthcare professionals, regarding certain clinical situations specific to temporary epicardial pacemaker in cardiac surgery was analysed. The findings show that, in general, the knowledge levels of the participants are concentrated between the responses 'I know moderately' and 'I know well'. However, it was observed that this distribution changed significantly in certain topics.

Table 3: Descriptive statistical analysis of participants' responses regarding ındications and complications of temporary epicardial pacemaker

Indications and Complications of Temporary Epicardial Pacemaker

Indications	Mean	Median	Mod	Standard deviation	I don't know at all (%)	Little I Know (%)	I Know Moderately (%)	I Know Well (%)	I know very well (%)
1. Complete Atrioventricular Block	3.6	4	4	1.2	5% (7)	10% (15)	30% (44)	40% (58)	15% (22)
2. Low Cardiac Output	3.3	3	3	1.1	7% (10)	13% (19)	35% (51)	35% (51)	10% (15)
3. Sinus Bradycardia	3.7	4	4	1.3	4% (6)	12% (18)	25% (37)	45% (66)	14% (20)
4. History of High Grade Atrioventricular Block	3.5	4	4	1.2	6% (9)	15% (22)	28% (41)	42% (61)	9% (13)
5. Postoperative Nodal Rhythm	3.4	3	3	1.2	5% (7)	14% (21)	30% (44)	38% (56)	13% (19)
6. Close Study of the Transmission System During Surgery	2.8	3	3	1.0	15% (22)	25% (37)	35% (51)	20% (29)	5% (8)
7. Presence of Preoperative Bifascicular Block	3.2	3	3	1.1	8% (12)	16% (24)	34% (50)	32% (47)	10% (14)
8. For the management of rhythm disorders and haemodynamic instability that may develop in the early period after open heart surgery	3.6	4	4	1.1	4% (6)	10% (15)	33% (49)	40% (58)	13% (19)
Complications									
9. Complications include infection, myocardial damage, ventricular arrhythmia, perforation and tamponade	3.1	3	3	1.2	10% (15)	22% (32)	38% (56)	22% (32)	8% (12)

The results of the study revealed that the majority of the participants did not have sufficient knowledge and experience about temporary epicardial pacemaker during the training process. The fact that even a small number of participants who stated that they had received training found this training inadequate indicates that the relevant topic is not sufficiently addressed in the curriculum at the undergraduate and postgraduate levels. In addition, the lack of a written protocol for temporary epicardial pacemaker applications and the lack of knowledge on this subject suggest that standardisation in clinical practices has

not been achieved. Although it has been reported that the preparation and follow-up of temporary epicardial pacemaker in cardiac surgery is mostly performed by perfusionists, this task distribution seems to be based on habit and experience rather than institutional protocols. These findings indicate both practice ambiguities that may lead to role confusion among healthcare professionals and potential risks for patient safety. Therefore, the development of standardised training modules for temporary epicardial pacemaker applications and the development of in-house written protocols stand out as an important necessity. It is also necessary to know the indications and complications of temporary epicardial pacemaker. Temporary epicardial pacemaker has many indications such as prevention of atrmias and maintenance of haemodynamic stability after CPB and complications such as myocardial damage (9).

The high level of knowledge especially about rhythm disorders such as 'Sinus Bradycardia' and 'Complete AV Block' may be due to the fact that these conditions are frequently encountered in clinical practice and diagnosis/treatment approaches are more clearly determined. The fact that the mean is above 3.6 and the mode and median values are 4 in both topics reveals that the participants have a good command of these topics.

On the other hand, it was found that the level of knowledge was relatively low in cases requiring more specific and technical knowledge such as "Working close to the conduction system during surgery". This finding indicates that although the participants have basic rhythm knowledge, they need training on more detailed topics such as the relationship between surgical anatomy and conduction system. The fact that 25% of the participants answered "I know a little" indicates a lack of awareness in this area. Similarly, the relatively low average for "Preoperative bifascicular block" suggests that more information on electrocardiographic risk assessment is needed.

It is observed that knowledge levels are concentrated at intermediate levels in situations that are critical for clinical management such as "Postoperative nodal rhythm" and "Low cardiac output". This may indicate a gap between theoretical knowledge and clinical practice. It is noteworthy that 14% of the respondents stated "Little knowledge" especially about postoperative nodal rhythm. This finding suggests that more emphasis should be placed on postoperative rhythm management in the training curriculum.

In addition, although the high level of knowledge on "Management of rhythm disturbances and haemodynamic instability that may develop after open heart surgery" (Mean: 3.6; 40% "I Know Well") is pleasing, the 33% "I Know Moderately" rate suggests that the level of knowledge is not homogeneously distributed in practice and hesitations may occur in decision-making processes in some clinical scenarios.

The level of knowledge regarding the complications associated with temporary epicardial pacemaker implantation was generally intermediate among the perfusionists who participated in the study. Despite potentially life-threatening complications such as infection, myocardial damage, ventricular arrhythmia, perforation and tamponade, only a small proportion of the participants described themselves as 'well' or 'very well' informed. This is a significant shortcoming in terms of early recognition and management of potential complications. In order to minimise the risk of complications and increase patient safety in temporary epicardial pacemaker applications, theoretical and practical trainings on this subject should be expanded. In addition, it is recommended to establish in-house guidelines on complication management and to implement regular in-service training programmes supported by current literature.

In general, perfusionists have a certain level of knowledge on the management of rhythm disorders and haemodynamic instability related to cardiac surgery, but they may lack knowledge on advanced evaluation and interventional decision processes. This suggests that case-based learning methods should be used more intensively in both undergraduate and postgraduate education programmes.

Recommendations in terms of education and clinical practice:

- *Standard training modules:* Case-based, visual content and simulation-supported training modules for the use of temporary epicardial pacemaker should be developed.

- *Knowledge testing with case scenarios:* Training contents should include scenarios that measure the participant's critical decision-making skills; this will increase the validity of the assessment.

- *Written clinical protocols:* Written guidelines for temporary pacemaker preparation, follow-up and complication management should be established to reduce inter-institutional differences.

- *In-service training programmes:* Periodic in-service training programmes should be organised to update knowledge based on current guidelines.

- *Multidisciplinary education:* Communication within the team should be strengthened with training meetings attended by cardiac surgeons, anaesthetists and perfusionists.

Conclusions

Temporary epicardial pacemaker is a critical tool in the management of postoperative rhythm disturbances in open heart surgery with CPB. While temporary epicardial pacemaker application requires multidisciplinary cooperation within the surgical team, perfusionists also play an active role in this process. There is information that perfusionists take responsibility for the preparation of temporary epicardial pacemaker cables, activation of the pacemaker device and intraoperative follow-up. However, this job description may vary from institution to institution and is often shaped by clinical habits rather than being based on written protocols. In conclusion, although the role of perfusionists in temporary epicardial pacemaker applications is important, the lack of clarification of these responsibilities by institutional protocols leads to uncertainties in practice. In order to maintain the use of temporary epicardial pacemakers in a safe and effective manner, it is necessary to establish standardised training and written guidelines for perfusionists.

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Contributions

Research concept and design: BA, MZB

Data analysis and interpretation: BA, MZB

Collection and/or assembly of data: BA, MZB

Writing the article: BA, MZB

Critical revision of the article: BA, MZB

Final approval of the article: BA, MZB

All authors read and approved the final version of the manuscript.

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