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Immediate Pericardial Protamine Administration During Uncontrollable Acute Iatrogenic Hemorrhagic Cardiac Tamponade: A Safety and Feasibility Study

Kontrol Edilemeyen Akut İyatrojenik Hemorajik Kardiyak Tamponad Sırasında Anında Perikardiyal Protamin Uygulaması: Bir Güvenlik ve Fizibilite Çalışması

LETTER TO THE EDITOR
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The increasing number of interventional electrophysiological procedures (IEPs) has led to a rise in the incidence of acute cardiac tamponade (CT), a common and life-threatening complication. Although the primary treatment for CT is percutaneous pericardiocentesis, rapid and effective pericardiocentesis may not be sufficient in some cases, ultimately necessitating surgical intervention.[1] Therefore, additional measures such as anticoagulant reversal, red blood cell transfusion, direct autotransfusion, and administration of prothrombin complex concentrates should be considered to stabilize the patient's hemodynamic status.[2] When these interventions fail, emergency surgery becomes necessary, an option associated with significant morbidity and mortality.[3] We would like to share our experience with intrapericardial protamine administration (IPPA) as a successful method for anticoagulation reversal and cardiac recovery. This approach aims to neutralize active heparin within the pericardial space, thereby limiting acute bleeding, slowing the progression of CT, and potentially avoiding the need for surgery.

We retrospectively reviewed the records of 1,958 patients who underwent catheter ablation between October 2019 and June 2022. A total of 34 patients developed procedure-related cardiac tamponade. Of these, 11 cases were treated with intrapericardial protamine administration. Emergency percutaneous pericardiocentesis was performed, and intravenous (IV) protamine was administered simultaneously in all patients. If hemodynamic stabilization was not achieved with these initial treatments, IPPA was employed prior to proceeding with surgery. Protamine was initially administered intrapericardially at a dose of 100 mg via the pericardiocentesis catheter and repeated at 100 mg every 3-4 minutes until either the progression of the effusion ceased with stabilization of blood pressure or the effusion required re-drainage due to ongoing hemodynamic compromise. The dosage we used was initially derived from the amount of heparin administered but was later adjusted and repeated at the operators' discretion, taking into account the patient's age, weight, and medical history.

Table 1 presents the baseline characteristics and outcomes of the 11 patients with CT who received IPPA. No systemic side effects were observed. Ultimately, only one patient required surgical intervention three hours later due to a large posterior atrioventricular (AV) sulcus tear and unfortunately died postoperatively. All other patients were discharged without further complications. A detailed description of all cases is provided in Table 2.

The optimal management strategy for cardiac tamponade remains unclear due to a lack of research. In this context, we aimed to introduce a novel therapeutic approach for acute CT. Notably, no massive blood clots or ongoing intrapericardial fluid accumulation were observed in any of the patients. In our study, anticoagulant therapy was re-initiated early, hospital stays were brief, and only two patients required allogeneic transfusions. However, our study should be interpreted with certain limitations in mind. The use of IPPA as a rescue therapy and the heterogeneity of our patient cohort represent

Table 1. Baseline Characteristics and Clinical Outcomes of the Study Population

Characteristics	n	%	Characteristics	n	%
Age	11	63.36 ± 11.79	Type of Ablation Procedure		
Female/Male	5/6	45.5/54.5	AF Ablation	3	27.3
HFrEF	11	47.27 ± 14.72	VT Ablation	3	27.3
Hypertension	7	63.6	PVC Ablation	4	36.4
Hyperlipidemia	4	36.4	Accessory Pathway Ablation	1	9.1
Smoking	4	36.4	Type of Catheter Used		
Diabetes Mellitus	4	36.4	Contact Force-Sensing Catheter	8	72.72
Obesity	2	18.2	Irrigated Catheter	2	18.18
Heart Failure	6	54.5	Non-Irrigated Tip Catheter	1	9.1
Chronic Renal Failure	1	9.1		**Mean**	**Min/Max**
Medication Profile			Time to Pericardial Drain Removal (hours)	40.8	24.0/48.0
Acetylsalicylic Acid	5	45.5	Length of Hospital Stay (days)	3.8	2.0/6.0
Warfarin	0	0	Time to Resume Anticoagulants (hours)	69.6	24.0/168.0
DOAC	4	36.4		**No (%)**	**Yes (%)**
DOAC + Antiplatelet	1	9.1	Cardiothoracic Surgery	10 (90.9%)	1 (9.1%)
None	1	9.1	Autotransfusion	9 (81.8%)	2 (18.2%)
			Mortality	10 (90.9%)	1 (9.1%)

AF, Atrial Fibrillation; DOAC: Direct-Acting Oral Anticoagulants; HFrEF, Heart Failure with Reduced Ejection Fraction, VT; Ventricular Tachycardia, PVC; Premature Ventricular Contractions; Min: Minimum; Max, Maximum.

Table 2. Detailed Characteristics of Patients in the Study Population

Case	Age	Sex	Type of Ablation	Anticoagulant/ Antiplatelet	Catheter Type	IV Protamine Dose	Drained Pericardial Fluid	Transfusion	EF	Time to Pericardial Drain Removal
1	49	M	PAF	Rivaroxaban	CFSC	100	200	No	60	2
2	71	F	PVC	ASA	Irrigated	100	450	No	60	2
3	73	F	PAF	Rivaroxaban	CFSC	100	350	No	60	2
4	70	M	VT	Rivaroxaban + ASA + Clopidogrel	CFSC	600	700	No	50	2
5	40	F	WPW	None	Non-Irrigated	100	400	No	60	1
6	62	F	PAF	Edoxaban	CFSC	100	600	Yes	25	1
7	81	M	PVC	ASA	Irrigated	100	450	No	30	1
8	63	M	VT	Edoxaban	CFSC	800	1200	Yes	25	Exitus
9	55	F	VT	ASA	CFSC	100	250	No	30	2
10	62	M	PVC	ASA	CFSC	100	350	No	25	2
11	71	M	VT	ASA	CFSC	100	400	No	40	4

ASA, Acetylsalicylic Acid; CFSC, Contact Force-Sensing Catheter; EF, Ejection Fraction; F, Female; IV, Intravenous; M, Male; PAF, Paroxysmal Atrial Fibrillation; PVC, Premature Ventricular Contraction; WPW, Wolff-Parkinson-White Syndrome.

key limitations. A comparison with a control group would have provided more insight into the efficacy of IPPA. Consequently, the safety of IPPA could not be fully established due to the small sample size.

In this hypothesis-generating study, IPPA appeared to be an effective and safe last-resort, bailout strategy in patients with life-threatening cardiac tamponade unresponsive to prior intravenous protamine administration, helping to avoid surgical intervention.

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