SHOCK-PRESS: A national survey investigating the use of vasopressors in cardiac patients experiencing cardio-circulatory shock

Antonio Giorgi[1*], Ferdinando Delor[1], Calogero Blanda[1], Andrea Crosignani[1], Giovanna Landi[2], Fabio Sangalli[3], Sabino Scolletta[4], Simona Silvetti[5], Massimo Baiocchi[6]; Fabrizio Monaco[7], Alessandro Marzio[1], Valentina Ajello[8], Tommaso Aloisio[9], Marco Ranucci[9], Cristina Santonocito[10], Michele Mondino[1], Gianluca Peternoster[11], Paolo Meani[1,2]

On behalf of ITACTAIC study group (Italian Association of Cardiothoracic Anaesthesiology and Intensive Care)

Affiliations:

1. Azienda Socio-Sanitaria Territoriale Grande Ospedale Metropolitano Niguarda, Department of Cardiothoracic and Vascular Anesthesia and Cardiothoracic and Vascular Intensive Care Unit, Milan, Italy

2. Maastricht University Medical Centre, Department of Cardiothoracic Surgery, Heart and Vascular Centre, Maastricht, Netherlands

3. Department of Anaesthesia and Intensive Care, ASST Valtellina e Alto Lario, University of Milano-Bicocca, 23020 Sondrio, Italy.

4. Department of Emergency and Organ Transplant, University of Siena, Siena, Italy.

5. Department of cardiac Anaesthesia and Intensive care, Ospedale Policlinico S Martino IRCCS Cardiovascular Network, Genova, Italy

6. Cardiothoracic and Vascular Anaesthesia and Intensive Care Unit, IRCCS Azienda ospedaliero-universitaria Bologna, Italy

7. Department of Anesthesia and Intensive Care, IRCCS San Raffaele Scientific Institute, Milan, Italy.

8. Department of Cardiothoracic Anaesthesia, Tor Vergata University Hospital, Rome, Italy

9. Department of Cadiovascular Anaesthesia and Intensive care, IRCCS Policlinico San Donato, San Donato Milanese, Italy

10. Department of Cardiothoracic Anaesthesia and Intensive Care, Policlinico G. Rodolico, Catania, Italy

11. Department of Cardiovascular Anesthesia and ICU, San Carlo Hospital, Potenza Italy.

Keywords: Shock, Vasoconstrictor, Cardiac

A national survey, endorsed by the Italian Association of Cardio-Thoracic Anesthesia and Intensive Care (ITACTAIC), was developed to investigate current practices regarding vasopressor use in surgical and medical cardiac patients experiencing cardiogenic, septic, or vasoplegic shock. The survey included 68 items, structured into five sections: (1) respondent and institutional demographics, (2) identification of cardiac patient populations, (3) identification of shock incidence and types, monitoring tools used and the adoption of standardized treatment protocols, (4) choice of vasopressors and inotropes including indications, dosing strategies, and hemodynamic targets, and (5) clinical perception of therapeutic effectiveness and adverse effect profiles of vasopressors. A total of 52 anesthesiologists affiliated to 40 Italian ICUs participated in the survey. Of these, 70.6% worked in cardiothoracic ICUs and 23.5% in general ICUs. Surprisingly only a minority of respondents followed specific treatment guidelines [Figure 1]: in septic shock 8.3% of respondents adhered to clear protocols while 41.7% used them with flexibility, the remaining 50% affirmed they were not using any protocol at all. In cardiogenic shock 2.2% of physicians employed standardized protocols while another 50% applied them with flexibility. In vasoplegic shock no respondent reported having clear guidelines and only the 34.8% applied some protocols with flexibility. The most employed vasopressor was noradrenaline in 95.7% of septic shock patients, 95.1% of vasoplegic shock cases and 67.4% of cardiogenic shock cases. The second most used vasopressor was arginine-vasopressin (AVP) in 80.4% of patients with septic shock and 80% of vasoplegic shock cases; AVP was also the second most used vasopressor in cardiogenic shock (52.4%). Interestingly, most respondents addressed side effects mainly to norepinephrine use; compared to AVP, it was judged responsible for peripheral and splanchnic ischemia, acute kidney injury, and arrhythmias in a majority of cases. Most clinicians affirmed that AVP seemed to have less impact on renal function and 43.9% thought that it may even improve it. While noradrenaline use reflects consolidated clinical practice and adherence to current recommendations (1) there is growing interest in AVP as an alternative vasoconstrictor. AVP exerts its vasopressor effect through non adrenergic V1a receptors and does not activate β_1-receptors; therefore, it increases systemic vascular resistance without stimulating heart rate and

myocardial contractility (2) [Table 1]. Moreover, AVP vasoconstrictive action is not exerted at the level of pulmonary circulation because V1a receptors are not expressed in those vessels: this phenomenon brings to light the possibility to use AVP in settings where not increasing pulmonary artery pressure is crucial, like in right ventricular failure (3). The perceived benefit on renal function can be explained by AVP's ability to cause vasoconstriction in efferent arterioles while sparing afferent arterioles, thereby preserving glomerular filtration and renal perfusion. Accordingly, some studies highlight the potential benefit of the early use of AVP in preventing acute kidney injury in septic shock patients (4). The main barrier to a broader use of AVP was not related to safety concerns, but to a lack of familiarity, reported by 26.2% of respondents. Only 11.9% expressed concerns about AVP-related side effects, compared to 24.4% for norepinephrine. As a matter of fact, 65.9% of clinicians reported they would consider changing their current first-line vasopressor strategy. This openness suggests growing awareness of the limitations of catecholamines, mainly in cardiac patients, and a shift toward individualized approaches that aim to balance hemodynamic efficacy with myocardial and renal protection. Not only AVP, but alternative vasopressors like angiotensin are also being employed with growing frequency in clinical practice. It has been demonstrated how angiotensin may be effective in reversing vasodilation even in refractory shock with absent response to high dose of standard vasopressor (5). These findings are drawn from self-reported practices and perceptions rather than objective clinical endpoints, and therefore primarily reflect therapeutic approaches currently adopted within the Italian healthcare system. Despite this limitation, this survey revealed a substantial and emerging lack of consensus that has led many clinicians to reconsider their vasopressor selection. Taken together, these results underscore the urgent need for rigorously designed randomized controlled trials, particularly in patient populations at elevated risk—such as those with impaired left ventricular function or pulmonary hypertension—who may benefit most from a non-adrenergic vasopressor strategy.

References:

1. Russell JA. Vasopressor therapy in critically ill patients with shock. Intensive Care Med. 2019 Nov;45(11):1503–17.

2. Hu K, Mathew R. Inotrope and vasopressor use in cardiogenic shock: what, when and why? Curr Opin Crit Care. 2022 Aug 1;28(4):419–25.

3. Hussain A, Bennett R, Haqzad Y, Qadri S, Chaudhry M, Cowen M, et al. The differential effects of systemic vasoconstrictors on human pulmonary artery tension. Eur J Cardio-Thorac Surg Off J Eur Assoc Cardio-Thorac Surg. 2017 May 1;51(5):880–6.

4. Gordon AC, Mason AJ, Thirunavukkarasu N, Perkins GD, Cecconi M, Cepkova M, et al. Effect of Early Vasopressin vs Norepinephrine on Kidney Failure in Patients With Septic Shock: The VANISH Randomized Clinical Trial. JAMA. 2016 Aug 2;316(5):509–18.

5. Khanna A, English SW, Wang XS, Ham K, Tumlin J, Szerlip H, et al. Angiotensin II for the Treatment of Vasodilatory Shock. N Engl J Med. 2017 Aug 3;377(5):419–30.

Address for correspondence:

Antonio Giorgi, MD

Cardiothoracic - vascular anesthesia and intensive care unit departement, ASST Grande Ospedale Niguarda Milan

Piazza dell'Ospedale Maggiore, 3, 20162 Milan (Italy)

Tel. 026444 2575 – Email: antonio.giorgi@ospedaleniguarda.it

Tables

Table 1. Comparative pharmacological profile of vasopressin and norepinephrine.

Agent	Chemical Structure	Mechanism of Action	Inotropic Effect	Cardiovascular and Renal Effects
Arginin Vasopressin (AVP)	**Cyclic peptide (non-catecholaminergic)**	**Selective V1a receptor agonist → activates PLC–IP_3–DAG–Ca^{2+} → smooth muscle contraction**	**None (no β_1-activity)**	**↑ SVR without tachycardia; selective efferent vasoconstriction preserves GFR and renal perfusion.**
Norepinephrine	**Catecholamine (tyrosine derivative)**	**Agonist of α_1 (vasoconstriction) and β_1 (inotropy and chronotropy)**	**Moderate (β_1-mediated↑ contractility dose-dependent)**	**↑ SVR and BP; non-selective vasoconstriction may reduce renal blood flow.**

Table 2. Distribution of survey respondents by center.

Center	Number of Respondents
AO San Camillo-Forlanini	1
AOU "G. Martino", Messina	1
AOU San Giovanni di Dio e Ruggi D'Aragona	1
Ospedale civile Sassari Ss. Annunziata	1
AOUI Verona	1
AOU Sant'Andrea	2
ARNAS AoBrotzu	1
ASST Papa Giovanni XXIII	1
Azienda Ospedale Santa Maria Terni	1
AOU Padova	2
AOU Policlinico Catania	1
CBH Mater Dei Hospital	2
Ospedale Ss. Annunziata Chieti	1
Azienda Ospedaliero Universitaria Careggi	2
Fondazione IRCCS policlinico San Matteo	1
Fondazione IRCCS Cà Granda Ospedale Maggiore Policlinico	3
Fondazione Policlinico Universitario Campus Bio-Medico	2

Ospedale San Giovanni Bosco	2
IRCCS Policlinico San Donato	2
Ospedale civile di Legnano	2
Ospedale Casa Sollievo della Sofferenza	1
Ospedale di circolo Varese	1
Ospedale di Sondalo	1
Ospedale Luigi Sacco	1
IRCCS Ospedale San Raffaele	3
Ospedale Santa Maria Bari	1
Ospedale Vittore Buzzi	1
AOU Parma	1
Casa di cura Pineta Grande	1
Policlinico di S.Orsola IRCCS	1
Fondazione Policlinico Tor Vergata	1
AOU Luigi Vanvitelli	1
AOR San Carlo	1
Unknown centers	7

Table 3. Respondent and Institutional Demographics

Variable	**Category**	% (n =52)
Age	30-40 years	34,6%
	40-50 years	44,2%
	>50 years	21,2%
		% (n =52)
Clinical role	Anesthesiologist	100%
	Cardiologist	0%
	Cardiac Surgeon	0%
	Other	0%
		% (n =51)
ICU type	Cardiothoracic ICU	70,6%
	General ICU	23,5%
	Other	5,9%
		% (n =52)
Years of experience	<5 years	23,1%
	5-10 years	19,2%
	10-20 years	36,5%
	>20 years	21,2%
		% (n =52)
Center level	Level I	17,3%
	Level II	36,5%
	Level III	46,2%
		% (n =52)
Transplant program affiliation	Yes	28,8%
	No	71,2%
		% (n =52)
University hospital	Yes	78,8%
	No	21,2%

Table 4. Patient population treated and distribution of shock types

Variable	**Category**	% (n =51)
Post-cardiac surgery	Yes	78,4%
	No	21,6%
		% (n =52)
Medical cardiac patients	Yes	88,5%
	No	11,5%
		% (n = 52)
Acute cardiac conditions	Yes	67,3%
	No	32,7%
		% (n = 52)
Pediatric patients	Yes	80,8%
	No	19,2%
		% (n =52)
Congenital heart disease	Yes	21,2%
	No	78,8%
		% (n =45)
Most frequent type of shock	Septic shock	44,4%
		% (n =47)
	Cardiogenic shock	31,9%
		% (n =45)
	Vasoplegic shock	15,6%

Table 5. Clinical monitoring and hemodynamic target

Septic shock		
Variable	**Category**	% Rated as Most Important (Score = 1)
		% (n = 45)
Monitoring tools *(*Scores range from 1 = most important to 5 = least important*)*	PAC	13,0%
		% (n= 45)
	CVC	8,7%
		% (n= 40)
	PiCCo	28,6%
		% (n= 45)
	Arterial catheter	43,5%
		% (n= 45)
	Echocardiography	26,7%
		% (n= 42)
	Lab evaluation of organ function	9,5%
		% (n= 45)
	Diuresis	22,2%
		% (n = 46)
Target MAP	60-65 mmHg	50,0%
	65-70 mmHg	45,7%
	70-75 mmHg	4,3%
	>75 mmHg	0,0%

(continued Table 5)

Vasoplegic shock		
Variable	**Category**	% Rated as Most Important (Score = 1)
		% (n = 38)
Monitoring tools (Scores range from 1 = most important to 5 = least important)	PAC	15,8%
		% (n = 40)
	CVC	10,0%
		% (n = 38)
	PiCCo	27,0%
		% (n = 41)
	Arterial catheter	43,9%
		% (n = 41)
	Echocardiography	31,7%
		% (n = 39)
	Lab evaluation of organ function	7,7%
		% (n = 41)
	Diuresis	14,6%
Variable	**Category**	% (n = 41)
Target MAP	60-65 mmHg	51,2%
	65-70 mmHg	41,5%
	70-75 mmHg	7,3%
	>75 mmHg	0,0%

(continued Table 5)

Cardiogenic shock		
Variable	**Category**	% Rated as Most Important (Score = 1)
Monitoring tools *(*Scores range from 1 = most important to 5 = least important*)*	PAC	% (n = 42) 28,6%
	CVC	% (n = 42) 11,9%
	PiCCo	% (n = 36) 27,8%
	Arterial catheter	% (n = 42) 35,7%
	Echocardiography	% (n = 42) 43,9%
	Organ function based on lab test	% (n = 39) 7,7%
	Diuresis	% (n = 41) 17,1%
Variable	**Category**	% (n = 43)
Target MAP	60-65 mmHg	37,2%
	65-70 mmHg	58,1%
	70-75 mmHg	4,7%
	>75 mmHg	0,0%

CVC: Central Venous Catheter; PAC: Pulmonary Artery Catheter

Table 6: Vasopressor use in different shock scenarios

PANEL A | Septic shock

Variable	Category	% (n =48)
Standard protocols available	Yes, with clear indications	8,3%
	Yes, flexible by case	41,7%
	No, case-by-case basis	50,0%
	I don't know	0,0%
		% (n = 46)
Timing of vasopressor initiation	Before volume resuscitation	23,9%
	With volume resuscitation	26,1%
	After volume resuscitation	34,8%
	If DO2 is inadequate	6,5%
	Depends on shock severity	8,7%
		% (n = 46)
First-line vasopressor	Adrenaline	2,2%
	Norepinephrine	95,7%
	Phenylephrine	0,0%
	AVP	2,2%
	AVP analogues	0,0%
	Other	0,0%
		% (n = 46)
Use of second-line vasopressor	Always	39,1%
	If high dose of first-line	58,7%
	If high arrhythmia risk	0,0%
	Rarely	2,2%
	Never	0,0%
		% (n = 46)
Second-line vasopressor	Adrenaline	4,3%
	Norepinephrine	4,3%
	Phenylephrine	0,0%
	AVP	80,4%
	AVP analogues	10,9%
	Other	0,0%

(continued Table 6)

PANEL B | Vasoplegic shock

Variable	Category	% (n =46)
Standard protocols available	Yes, with clear indications	0,0%
	Yes, flexible by case	34,8%
	No, case-by-case basis	65,2%
	I don't know	0,0%
		% (n = 41)
Timing of vasopressor initiation	Before volume resuscitation	39,0%
	With volume resuscitation	31,7%
	After volume resuscitation	19,5%
	If DO2 is inadequate	2,4%
	Depends on shock severity	7,3%
		% (n = 41)
First-line vasopressor	Adrenaline	0,0%
	Norepinephrine	95,1%
	Phenylephrine	0,0%
	AVP	4,9%
	AVP analogues	0,0%
	Other	0,0%
		% (n = 41)
Use of second-line vasopressor	Always	24,4%
	If high dose of first-line	65,9%
	If high arrhythmia risk	0,0%
	Rarely	7,3%
	Never	2,4%
		% (n = 40)
Second-line vasopressor	Adrenaline	7,5%
	Norepinephrine	2,5%
	Phenylephrine	0,0%
	AVP	80,0%
	AVP analogues	10,0%
	Other	0,0%

(Continued table 6)

PANEL C | Cardiogenic shock

Variable	Category	% (n = 46)
Standard protocols available	Yes, with clear indications	2,2%
	Yes, flexible by case	50,0%
	No, case-by-case basis	47,8%
	I don't know	0,0%
		% (n = 47)
Etiologies of cardiogenic shock	AMI	36,2%
	Cardio-thoracic surgery	29,8%
	Acute on chronic heart failure	17,0%
	Acute heart failure	10,6%
	Other causes	4,3%
	Post-cardiac arrest syndrome	2,1%
	Myocarditis	0%
	Acute valvular insufficiency/stenosis	0%
	Arrhythmias	0%
		% (n =45)
SCAI stage for vasopressor use	A	2,2%
	B	24,4%
	C	55,6%
	D	15,6%
	E	2,2%
		% (n =43)
Inotrope use	Dobutamine	46,5%
	Dopamine	2,3%
	Adrenaline	41,9%
	Milrinone	0,0%
	Levosimendan	9,3%
	Others	0,0%
		% (n = 43)
First-line vasopressor	Adrenaline	25,6%
	Norepinephrine	67,4%
	Phenylephrine	0,0%
	AVP	4,7%
	AVP analogues	0,0%
	Other	2,3%
		% (n = 43)
Use of second-line vasopressor	Always	20,9%
	If high dose of first-line	62,8%

	If high arrhythmia risk	0,0%
	Rarely	14,0%
	Never	2,3%
		% (n = 42)
Second-line vasopressor	Adrenaline	9,5%
	Norepinephrine	28,6%
	Phenylephrine	0,0%
	AVP	52,4%
	AVP analogues	4,8%
	Other	4,8%

Table 7. Vasopressor outcomes and side effects

Variable	**Category**	% (n =42)
Observed clinical outcomes with AVP	Reduced vasopressor requirement	50,0%
	Improved organ perfusion	31,0%
	No significant difference	7,1%
	Insufficient data	11,9%
		% (n = 41)
Effect of AVP on renal function	Improved diuresis and renal function	43,9%
	No significant impact	43,9%
	Worsened renal function	2,4%
	No direct experience	9,8%
		% (n = 40)
Effect of Norepinephrine on renal function	Improved diuresis and renal function	15,0%
	No significant impact	40,0%
	Worsened renal function	40,0%
	No direct experience	5,0%
		% (n = 42)
Side effects with Norepinephrine *(Multiple choice)*	Arrhythmia	9,3%
	Tachycardia	14,0%
	Peripheral ischemia	65,1%
	Splanchnic ischemia	41,9%
	Acute kidney injury (AKI)	37,2%
	None	9,3%
	Other	0,0%
		% (n = 42)
Side effects with AVP *(Multiple choice)*	Arrhythmia	2,4%
	Tachycardia	4,8%
	Peripheral ischemia	54,8%
	Splanchnic ischemia	33,3%
	Acute kidney injury (AKI)	7,1%
	None	28,6%
	Other	2,4%
		% (n = 29)
Side effects with AVP analogues *(Multiple choice)*	Arrhythmia	0,0%
	Tachycardia	6,9%
	Peripheral ischemia	69,0%

	Splanchnic ischemia	34,5%
	Acute kidney injury (AKI)	20,7%
	None	24,1%
	Other	0,0%
		% (n = 42)
Main limitations in using AVP	Side effects	11,9%
	Lack of familiarity	26,2%
	Preference for other vasopressors	2,4%
	No significant limitations	59,5%
		% (n = 41)
Main limitations in using Norepinephrine	Side effects	24,4%
	Lack of familiarity	0,0%
	Preference for other vasopressors	0,0%
	No significant limitations	75,6%
		% (n = 42)
Catecholamine need reduction with AVP	Significant	76,2%
	Not clinically relevant	16,7%
	No direct experience	4,8%
	No	2,4%
		% (n = 42)
Would you consider changing first-line vasopressor?	Yes	65,9%
	No	34,1%