

In vivo Evans blue dye infusion allows monitoring of autoreperfusion in a rat model of cardiac ischemia

Kate Hsiurong Liao¹, Eva Yuhua Kuo¹, Kuen-Bao Chen¹, Ted Weita Lai^{1,2}

¹Graduate Institute of Clinical Medical Science, China Medical University, Taichung, Taiwan

²Translational Medicine Research Center, China Medical University Hospital, Taichung, Taiwan



Abstract

Material and Method

Animal:

- Male Sprague-Dawley rats
- Weight: 310-370g
- Age: 8-9 weeks

Evan's blue dye(EBD):

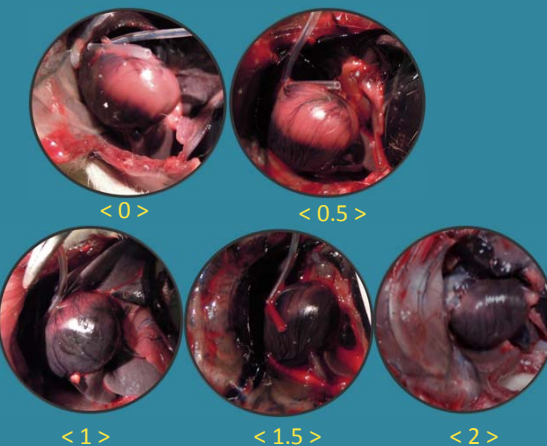
- Concentration- 4%
- Dose- 2ml/kg
- Route- venous cannula

Surgery:

- Anesthetic- Isoflurane (3% for induction; 2% for maintain)
- Creation of arterial and venous cannulas
- Ligation of Left anterior descending artery
- Ischemia 5 mins then reperfusion 5 mins
- Recording: ECG, BP, HR, body temperature

Evan's blue dye Performance:

Divided to 5 degrees-



Results

Figure 1. Ischemia induced ventricular arrhythmias

	Evan's blue staining	Ischemia			Reperfusion		
		PVCs (n)	VT(sec)	VF (sec)	PVCs (n)	VT(sec)	VF (sec)
Failure to Reperfuse	0-0.5 (0.5)	1	18.7	0	32	36.0	3.4
	0.0 (1.5)	3	0	0	0	15.2	34.8
	0-0.5 (1.5)	3	0	0	0	8.1	37.2
Perfect	0-0.0 (2)	7	0	0	0	3	57
Ischemia	0-0.0 (2)	0	0	0	1	10.9	49.1
		0	0	0	0	0	0
		0	0	0	13	38.7	0
		0	0	0	12	0	0
Minor Auto-reperfuse	0.0-1 (2)	2	0	0	9	17	43.3
		0	0	0	20	16.7	43.3
		0	0	0	105	45.0	6.8
		0	0	0	48	5.1	0
		0	0	0	124	2.2	0
Late Auto-reperfuse	0.5-1.5 (2)	1	0	0	3	11.2	27.8
	1-1.5-1.5 (2)	1	0	0	2	3	57
		2	0	0	4	12	0
Early Auto-reperfuse	0-1.5-2 (2)	1	0	0	12	0	0
		4	0	0	3	0	0
Poor Ligation	1.5-2-2 (2)	3	0	0	18	0	0
		15	0	0	3	0	0

^{ns}Abbreviations: PVC, post-ventricular contraction; VT, ventricular tachycardia; VF, ventricular fibrillation.

Figure 2. Hemodynamic parameters

	Evan's blue staining	Blood Pressure (mmHg)				Heart Rate (beats per min)			
		Pre-ISC	Post-ISC	Pre-REP	Post-REP	Pre-ISC	Post-ISC	Pre-REP	Post-REP
Failure to Reperfuse	0-0.5 (0.5)	84	64	45	-	276	317	234	-
	0-0.0 (1.5)	104	72	99	68	173	134	265	299
	0-0.5 (1.5)	85	60	46	38	251	306	256	40
Perfect	0-0.0 (2)	89	73	73	-	179	200	272	-
Ischemia	0-0.0 (2)	62	50	67	-	255	332	358	-
		76	63	79	88	241	294	283	252
		78	67	87	71	251	263	274	38
		79	64	102	117	280	239	298	277
Minor Auto-reperfuse	0.0-1 (2)	104	87	109	-	344	365	366	-
		87	84	117	-	212	333	363	-
		55	49	45	41	326	135	44	35
		94	80	91	93	234	227	270	241
		81	75	110	105	190	264	290	226
Late Auto-reperfuse	0.5-1.5 (2)	99	81	113	-	298	357	348	-
	1-1.5-1.5 (2)	75	79	116	-	228	287	361	-
		121	115	113	128	147	379	514	380
Early Auto-reperfuse	0-1.5-2 (2)	112	114	91	88	307	367	376	320
		85	90	90	94	373	376	412	408
Poor Ligation	1.5-2-2 (2)	102	98	116	116	187	211	410	379
		117	114	134	124	238	281	335	306

^{ns}Abbreviations: ISC, ischemia; REP, reperfusion.



Adequate reperfusion after release of ligation (The heart become homogeneously dyed)



Failure to reperfuse (Some ischemia region could not be completely perfused after release of ligation)

Summary

1. In vivo Evans blue dye infusion allows monitoring of autoreperfusion in a rat model of cardiac ischemia.
2. Partial ischemia due to autoreperfusion can predict ischemia outcomes.

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Introduction

Background

The rat model of cardiac ischemia has been commonly used in the research of ischemia induced ventricular arrhythmias. However, this model produces the huge variability in the degree and the actual duration of coronary occlusion because of auto-reperfusion that results in partial-ischemia.

Questions of interest

1. Whether autoreperfusion after coronary ligation could be monitored by injecting Evan's blue dye intravenously *in vivo*?
2. Whether autoreperfusion could predict ischemia outcome (ventricular arrhythmias)?

Working hypothesis

1. In vivo injection immediately after coronary ligation can help to monitor autoreperfusion and allow to exclude rats with partial ischemia.
2. Variant degrees of partial ischemia will lead to inconsistent outcome such as ventricular arrhythmias.