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Come gestire le emergenze aritmiche

Corrado Di Mambro

Resp. di Alta Specializzazione in Aritmologia Clinica delle Cardiopatie Congenite – Osp. Pediatrico «Bambino Gesù» di Roma

Bambino Gesù
OSPEDALE PEDIATRICO

1946


REFERENDUM SULLA FORMA ISTITUZIONALE DELLO STATO

Referendum über die Staatsform

REPUBBLICA

Republik

MONARCHIA

Monarchie

Apporre un segno nella casella a fianco del contrassegno prescelto

Ein Zeichen beifügen im Quadrat neben dem ausgewählten Symbol

DIAGNOSIS AND TREATMENT OF CARDIAC ARRHYTHMIAS

SAMUEL BELLET, M.D.*

THE subject of cardiac arrhythmias is of considerable importance for several reasons. These disturbances are common. They frequently produce intense anxiety on the part of the patient. The rapid rate often precipitates heart failure. The arrhythmia can in most instances be diagnosed easily, either clinically or by graphic methods, and results of treatment of these disturbances are among the most satisfactory observed in any field of medicine.

The term "arrhythmia" is frequently used synonymously with clinical disorders of the heart beat and disturbances of the cardiac mechanism. The latter terms are preferable because, while the rhythm is often irregular, many of these disorders, for example paroxysmal auricular tachycardia, auricular flutter, complete heart block and others, display an absolutely regular rhythm.

The following information is of help in establishing the clinical diagnosis: the age of the patient, the ventricular rate, the type of heart condition and the presence of irregularities. These disorders are comparatively rare below the age of 10. From 10 to 20 years the types of irregularities encountered are sinus arrhythmia (usually phasic in type), extrasystoles, auricular fibrillation and varying degrees of auriculoventricular heart block.

Between the ages of 20 and 30 most of the irregularities observed are those usually seen in rheumatic hearts, namely varying degrees of auriculoventricular heart block, auricular fibrillation and extrasystoles. From 30 to 45 syphilitic heart disease is also encountered. Although auricular fibrillation is rare in syphilitic heart disease, various degrees of auriculoventricular heart block, extrasystoles and paroxysmal tachycardia are encountered. In addition, the disturbances in the cardiac mechanism following digitalization are observed. From the age of 45 on, one encounters a preponderant number of hearts of the degenerative type.

Other factors of importance in the diagnosis of the arrhythmias are the underlying heart condition, the presence of heart failure, the symptoms and signs presented by the patient, the response to carotid sinus pressure and, finally, the electrocardiographic findings.

From the Division of Cardiology, Philadelphia General Hospital, and the Edward B. Robinette Foundation, University of Pennsylvania, Philadelphia.

* Assistant Professor of Cardiology, Graduate School of Medicine, University of Pennsylvania.

1948

ORIGINAL ARTICLES | SEPTEMBER 01 1948

TREATMENT OF AN INFANT WITH PAROXYSMAL AURICULAR TACHYCARDIA

ROBERT L. MOORE

Pediatrics (1948) 2 (3): 266–271.
https://doi.org/10.1542/peds.2.3.266 **Article history**

Share Tools

Paroxysmal tachycardia occurs more frequently in infants, than is generally recognized; and, undoubtedly, is frequently misdiagnosed.

A case is reported of an infant who had 31 attacks of paroxysmal tachycardia between the ages of eight days and five and a half months. Many of the paroxysms would not stop spontaneously and heart failure would occur.

Quinidine, acetyl-beta-methylcholine, and digitalis were all found to be effective in controlling the attacks. The first two seemed to be more effective than the last. Because of the violent reaction to acetyl-beta-methylcholine, it is thought best to use this method only if the other two fail to bring relief.

Neonatal and Pediatric Arrhythmias

Clinical and Electrocardiographic Aspects

Fabrizio Drago, MD*, Irma Battipaglia, MD,
Corrado Di Mambro, MD

KEYWORDS

• Children • Neonates • Arrhythmias • ECG • Bradycardia • Tachycardia • Pediatric arrhythmias

KEY POINTS

- Correct interpretation of an electrocardiogram in children and neonates has different principles from adults; detailed knowledge of these age-dependent changes should be well-known to avoid misinterpretation.
- It is important to know that sinus arrhythmia, ectopic atrial rhythm, "wandering pacemaker," and functional rhythm can be normal characteristics in children.
- Treatment of tachyarrhythmias in children depends on natural history, and height and weight of the patient; in small children, medical treatment can postpone transcatheter ablation.
- Bradyarrhythmias can require pacemaker implantation in children.
- Endocardial or epicardial approach should be chosen depending on the weight and the height of the patient.

PLACE
PLATFORM OF LABORATORIES FOR ADVANCES IN CARDIAC EXPERIENCE

8ª Edizione

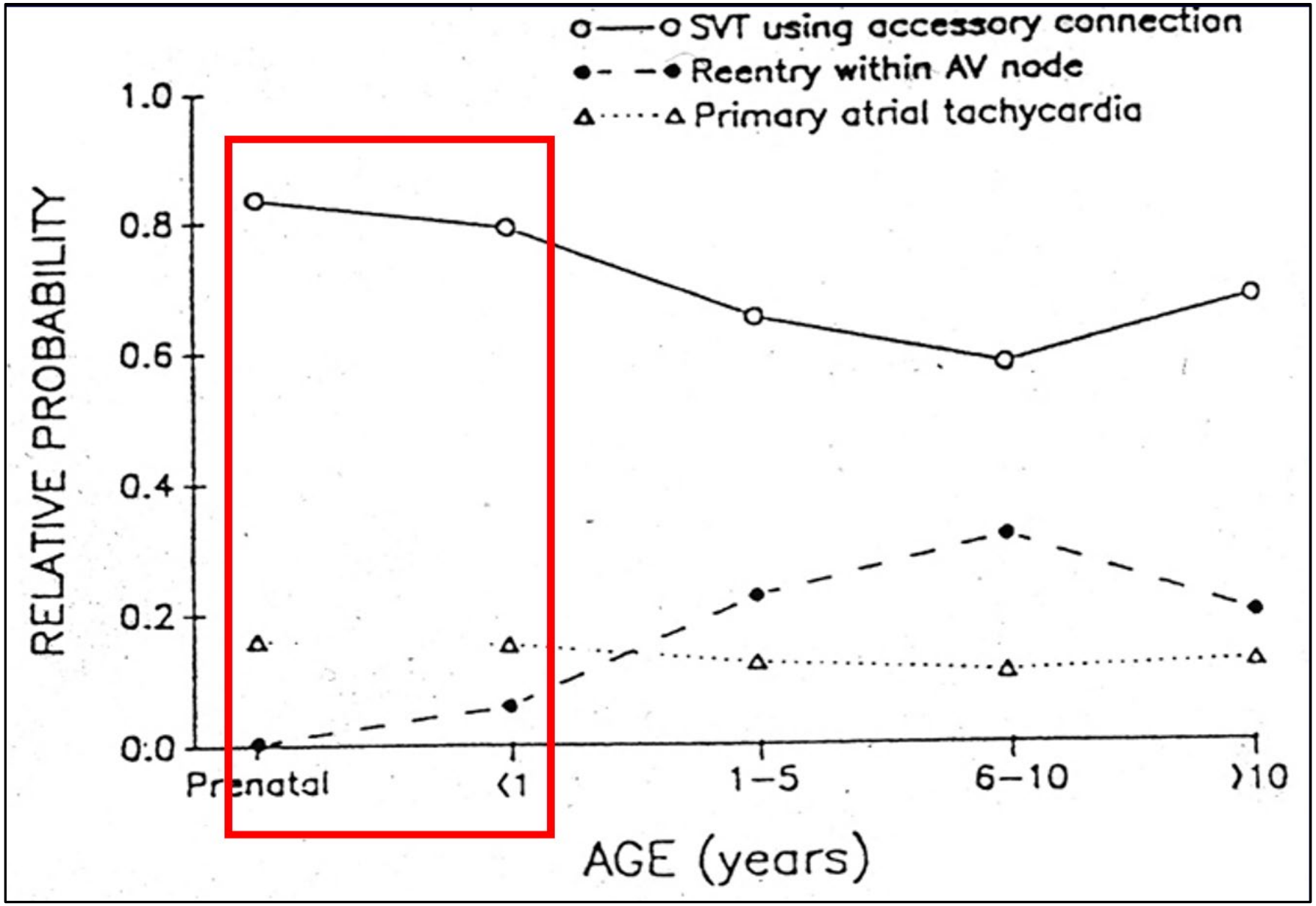
La corretta interpretazione dell'ECG nei bambini e nei neonati si basa su parametri diversi tra loro e soprattutto dall'adulto...

...questi dettagli età-correlati dovrebbero essere considerati per evitare delle errate interpretazioni.

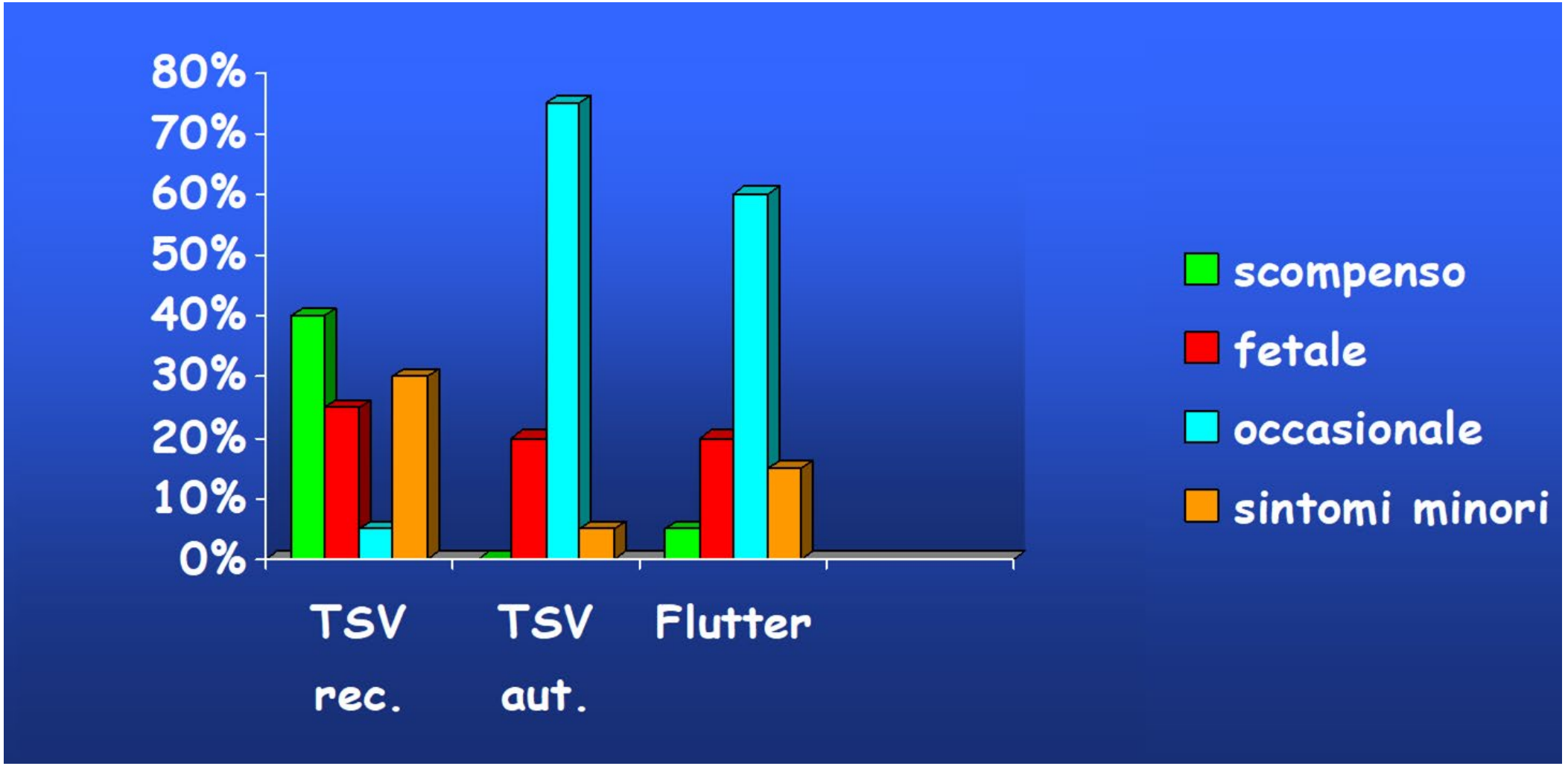
Neonatal and Pediatric Arrhythmias
Clinical and Electrocardiographic Aspects

Fabrizio Drago, MD*, Irma Battipaglia, MD,
Corrado Di Mambro, MD

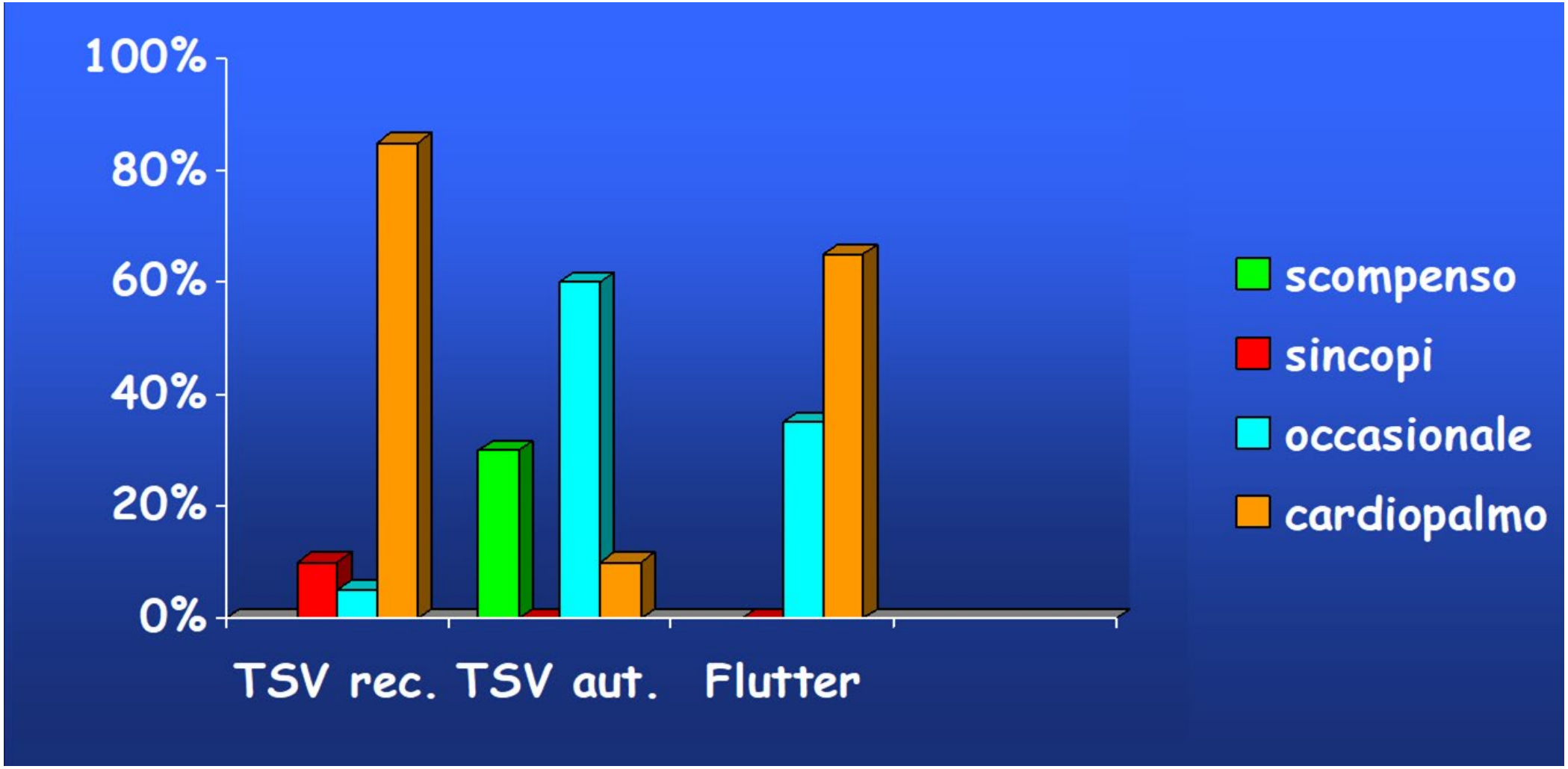
Le TSV in età neonatale e pediatrica



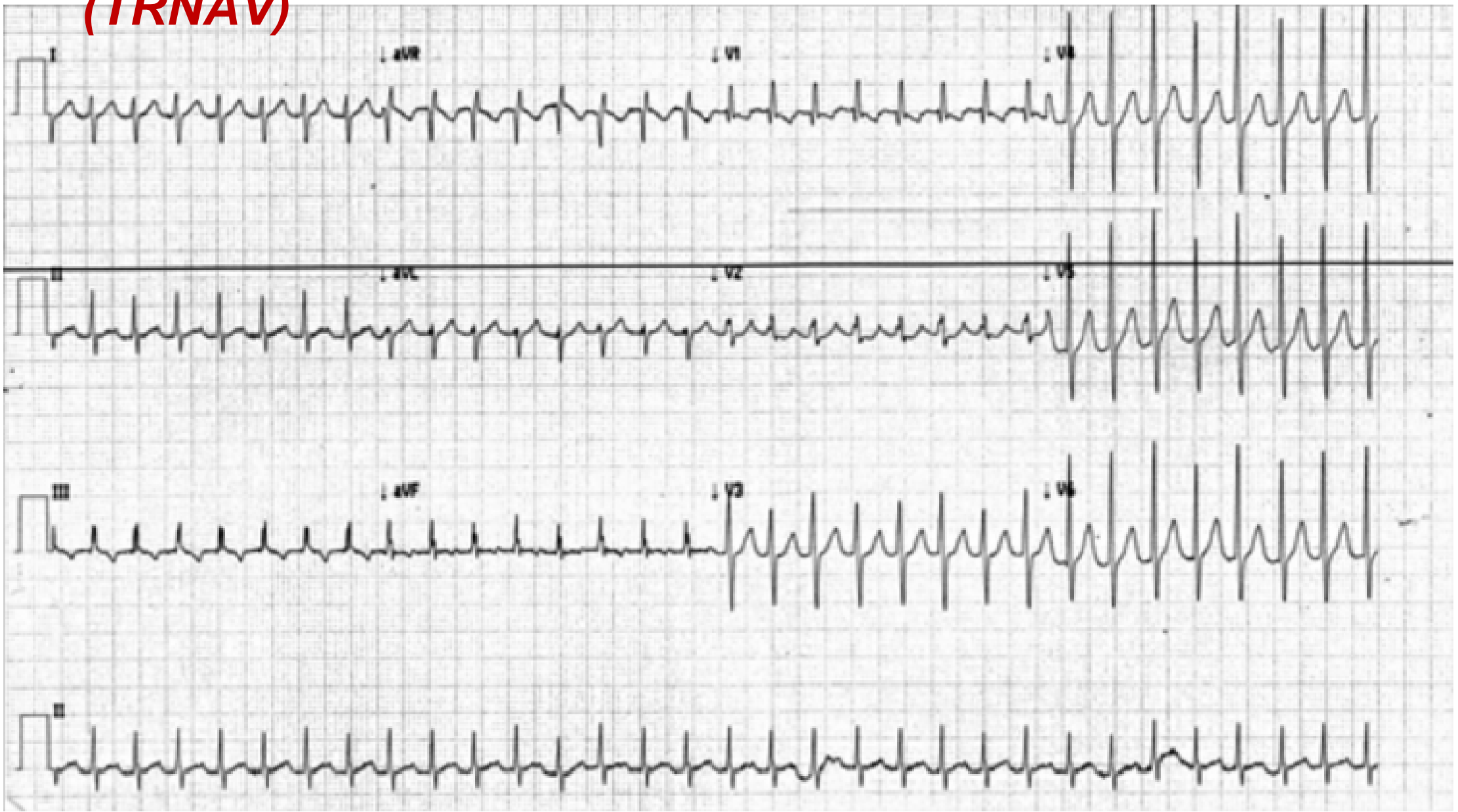
MODALITÀ DI PRESENTAZIONE DELLE TACHICARDIE SOPRAVENTRICOLARI NEL PRIMO ANNO DI VITA



MODALITÀ DI PRESENTAZIONE DELLE TACHICARDIE SOPRAVENTRICOLARI DOPO IL PRIMO ANNO DI VITA

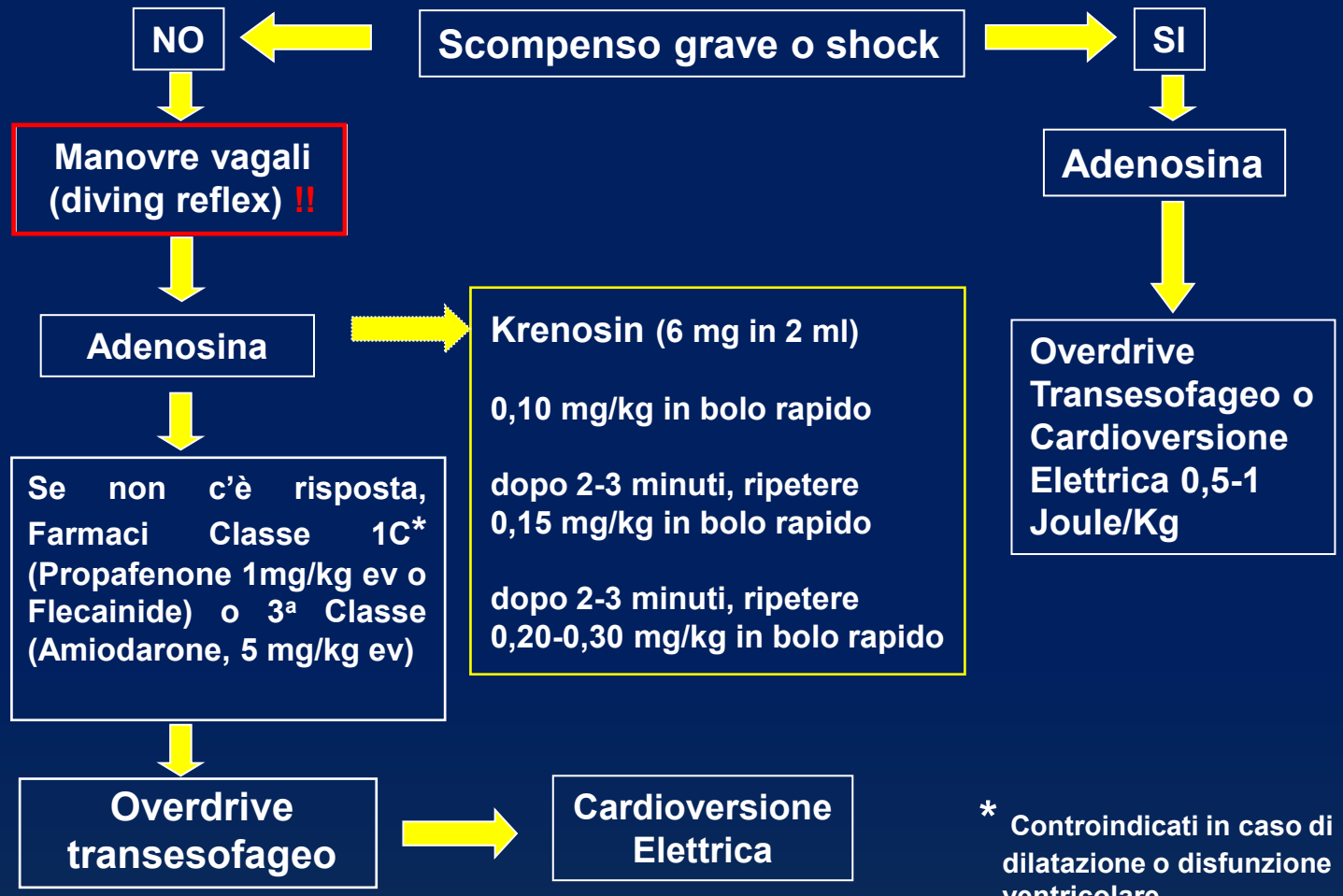


Tachicardia da rientro AV (TRAV) o nel NAV (TRNAV)




aVr
V1
V4
aVl
V2
V5
V3
V6

TRATTAMENTO ACUTO DELLA TPSV DA RIENTRO



* Controindicati in caso di dilatazione o disfunzione ventricolare

TRATTAMENTO ACUTO DELLA TPSV DA RIENTRO

Table 1 Recommendations for acute treatment of haemodynamically stable regular narrow QRS tachycardia in infants and children

Drug/intervention	Dosage (iv)	Class	Level
Vagal manoeuvres	Ice immersion, gastric tube insertion in infants, Valsalva, and head stand in older children	I	B
Transoesophageal atrial overdrive pacing[a]		I	B
Adenosine	Rapid bolus starting dosages:		B
	For infants: 0.15 mg/kg.	I	
	For >1 year of age: 0.1 mg/kg Increasing dosage up to 0.3 mg/kg.	I	
Verapamil[b,c]	0.1 mg/kg slowly over 2 min	I	B
Flecainide[b]	1.5–2 mg/kg over 5 min	IIa	B
Propafenone[b]	Loading: 2 mg/kg over 2 h Maintenance: 4–7 μg/kg/min	IIa	B
Amiodarone	Loading: 5–10 mg/kg over 60 min. Maintenance infusion:5–15 μg/kg/min	IIb	B

iv, intravenously; Class, recommendation class; Level, level of evidence.
[a]Most effective if AV reentrant tachycardias or atrial flutter.
[b]Myocardial depressant effect.
[c]Contraindicated in infants <1 year of age.

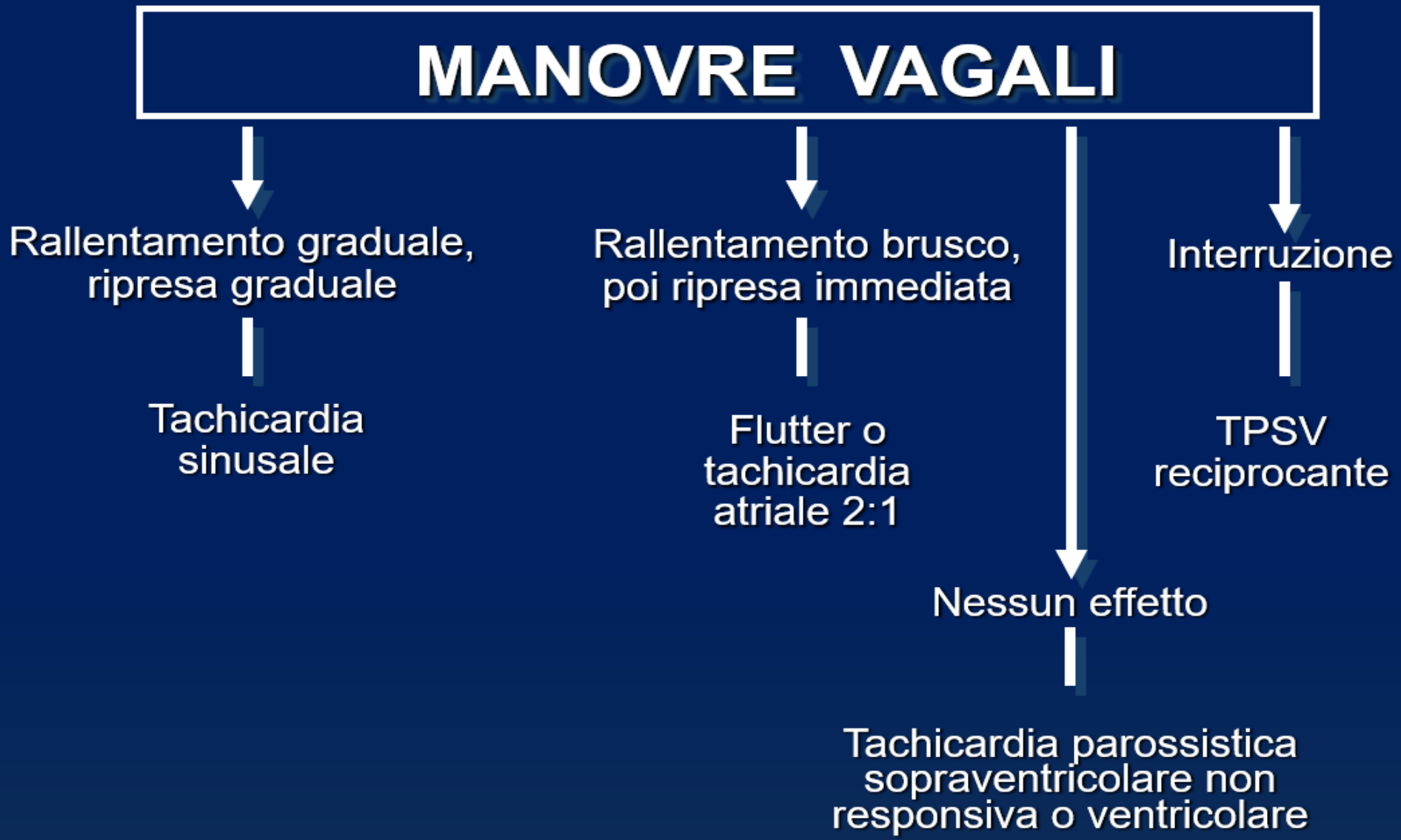
MANOVRE VAGALI

Usate generalmente nei bambini con TSV emodinamicamente stabili che coinvolgono il nodo AV come parte del loro circuito di rientro.

Tali manovre inducono un effetto dromotropico negativo sul nodo AV.

Usate come trattamento iniziale sia per la loro semplicità sia per la loro relativa non invasività .

TACHICARDIE RITMICHE

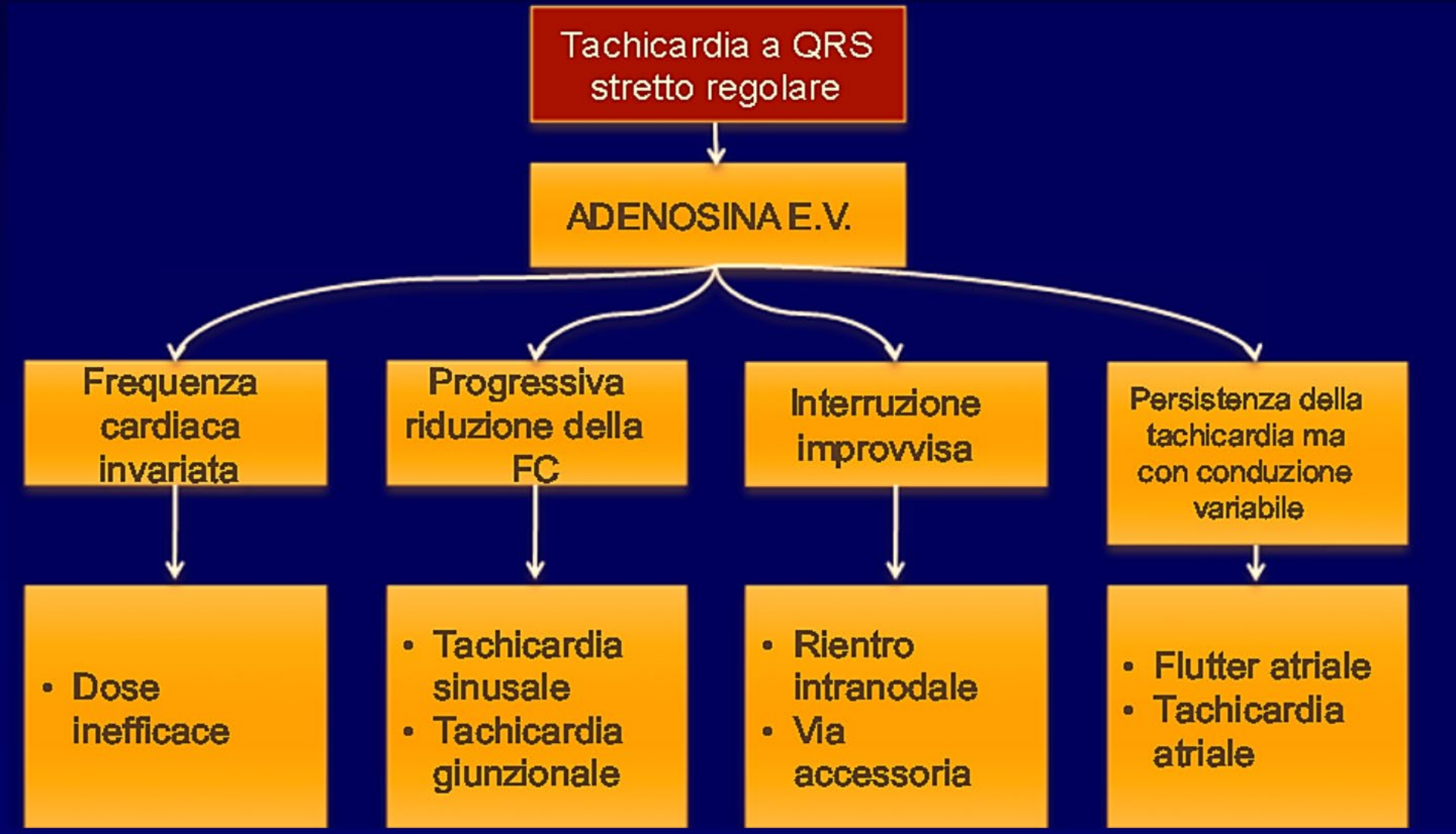


MANOVRE VAGALI

Le più usate nei bambini sono:

1. “il diving reflex”
2. la manovra di Valsalva
3. la pressione sul plesso solare (sui lattanti ed i bambini in età prescolare)
4. il massaggio sul seno carotideo (solo nei bambini più grandi e negli adolescenti).

ADENOSINA E.V.

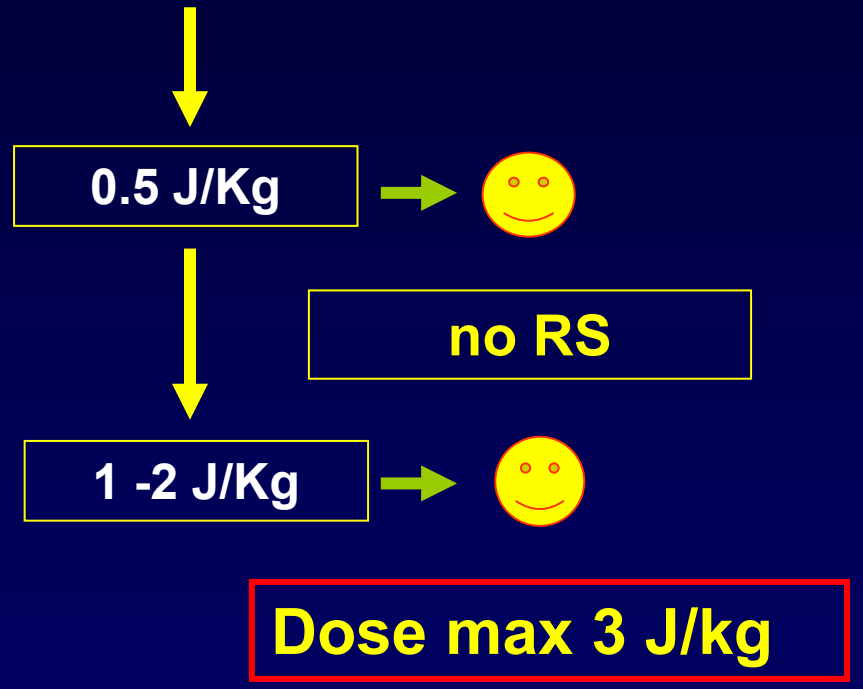


CARDIOVERSIONE ELETTRICA SINCRONIZZATA NELLE TSV DA RIENTRO

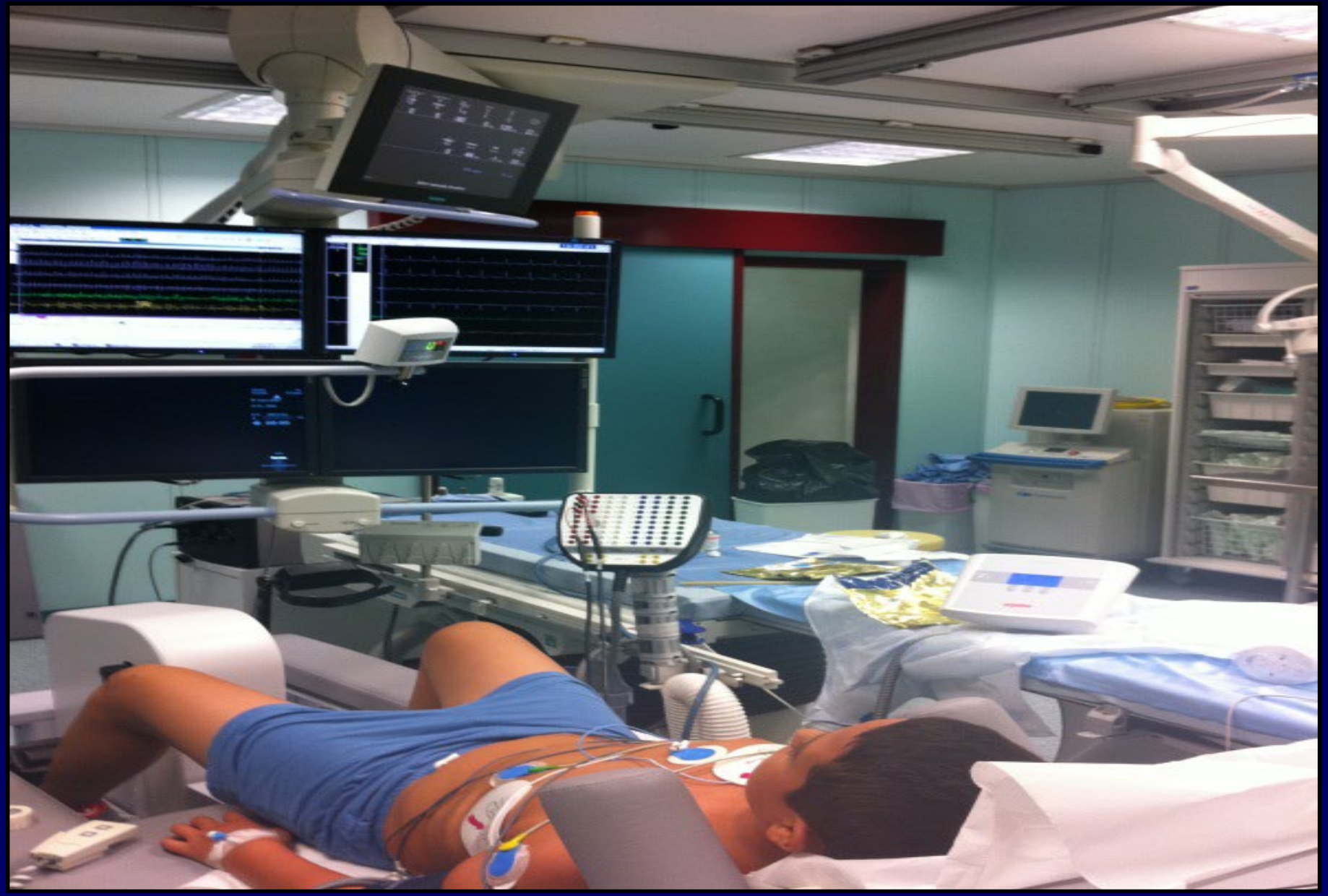
Sincronizzata vuol dire che lo shock viene erogato in coincidenza del QRS (uno shock che cada in fase vulnerabile, cioè sull'onda T può scatenare la FV!).

SOLO nella FV/TV senza polso si eroga lo shock senza la sincronizzazione

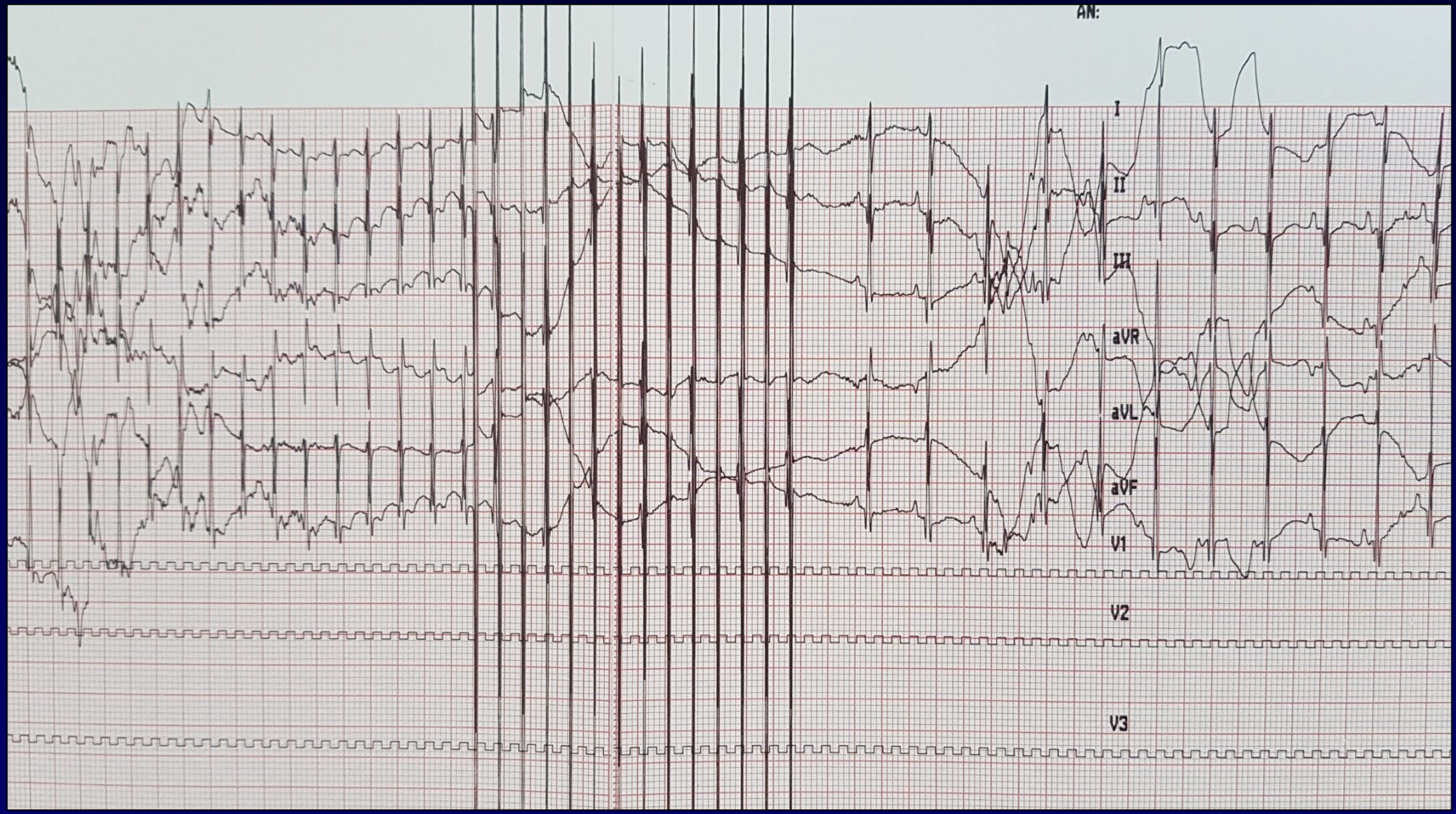
Se possibile, sedare il paziente (diazepam, midazolam, ketamina, fentanile)



STIMOLAZIONE ATRIALE TRANSESOFAGEA (SATE)



STIMOLAZIONE ATRIALE TRANSESOFAGEA (SATE)



TPSV DA VIA ANOMALA (TRAV/TRNAV)

Terapia Farmacologica e.v.

- ✓ Bloccanti la Via Anomala

TPSV DA VIA ANOMALA (TRAV/TRNAV)

Terapia Farmacologica e.v.

Bloccanti la Via Anomala

Propafenone **bolo:** *0.5-2 mg/kg in 15'*
mantenimento*: 10-15 mg/kg/die*

Flecainide **bolo:** *1-2 mg/kg in 15'*
mantenimento: *3-5 mg/kg/die*

Amiodarone **bolo:** *5 mg/kg in 20'-60'*
mantenimento: *10 mg/kg/die*

Sotalolo **bolo :***1-1.5 mg/kg in 20'*
mantenimento: *3-8 mg/kg/die*

TPSV DA VIA ANOMALA (TRAV/TRNAV)

Terapia Farmacologica e.v.

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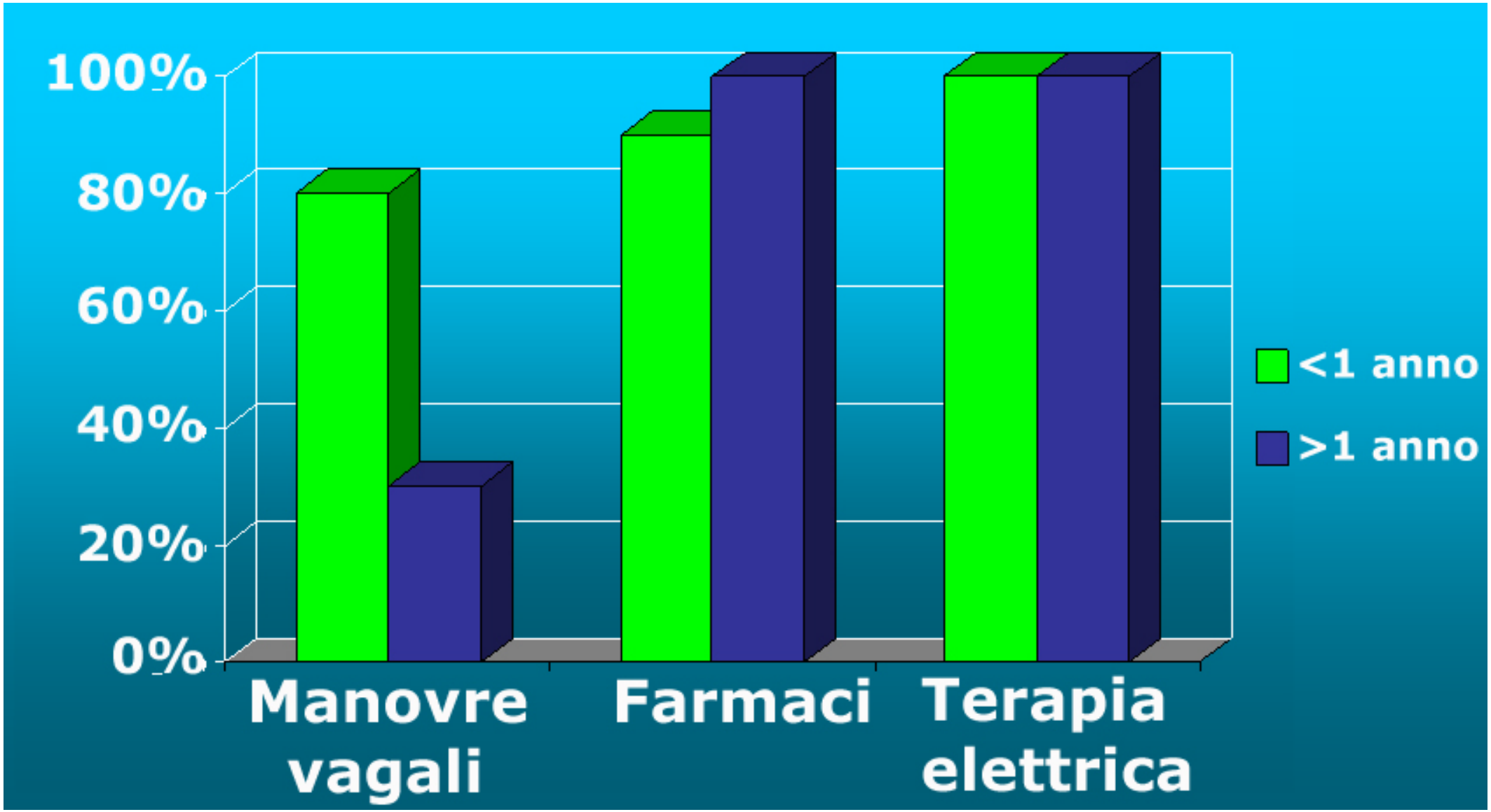
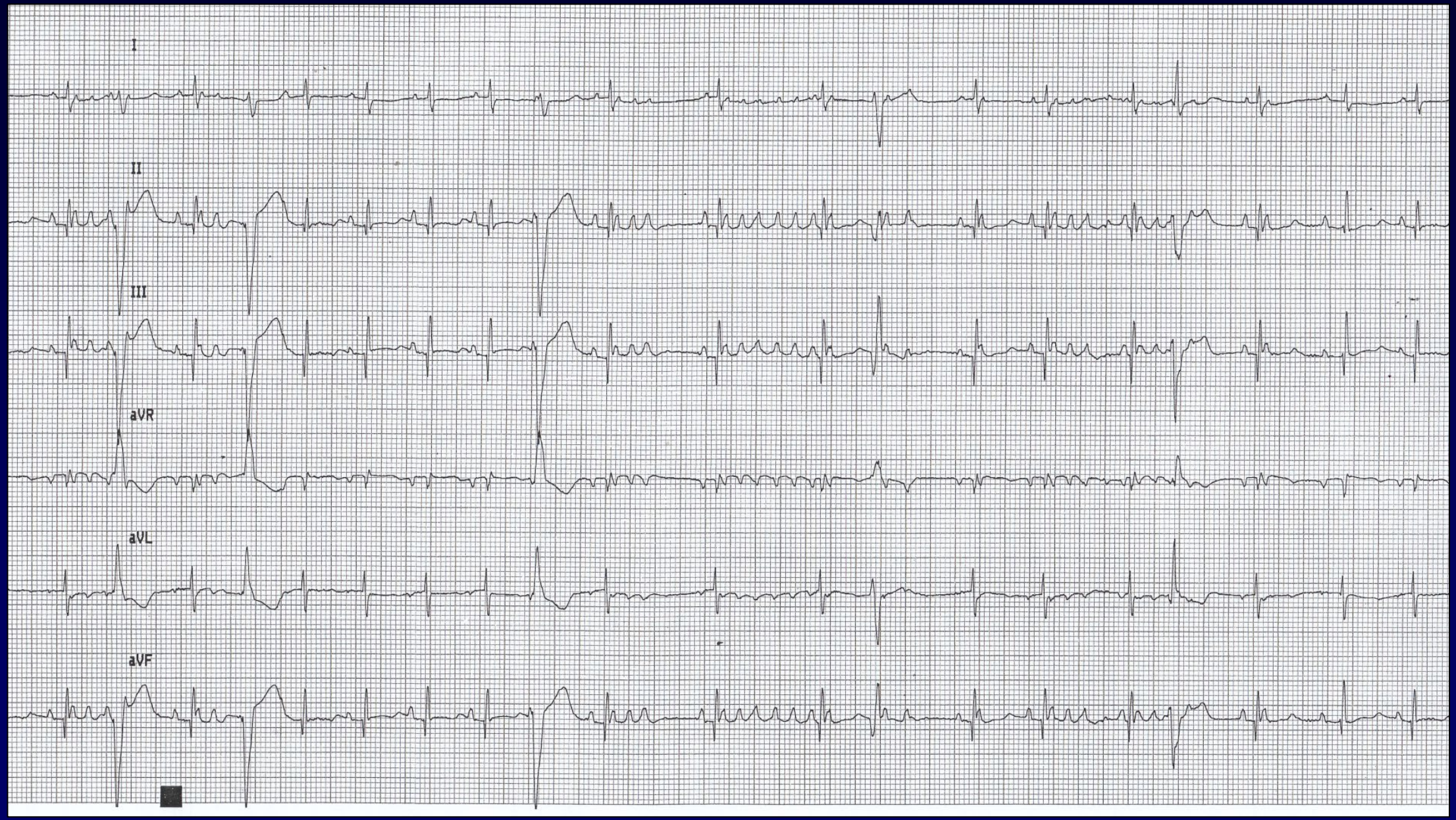
EFFICACIA DELLA TERAPIA ACUTA



TACHICARDIA ATRIALE ECTOPICA



TACHICARDIA ATRIALE ECTOPICA
Terapia farmacologica

Paziente in compenso?

- ✓ **Digitale Inefficace ed inutile**
- ✓ **Iniziare terapia antiaritmica**
  - **Os**
  - **e.v.**

TACHICARDIA ATRIALE ECTOPICA
Terapia farmacologica (pz. In compenso)

Ivabradine for treatment of tachyarrhythmias in children and young adults

Christopher M. Janson, MD,* Reina Bianca Tan, MD,† V. Ramesh Iyer, MD,*
R. Lee Vogel, MD,* Victoria L. Vetter, MD,* Maully J. Shah, MBBS, FHRS*

*From the *Division of Cardiology, Children's Hospital of Philadelphia, Perelman School of Medicine at the University of Pennsylvania, Philadelphia, Pennsylvania, and †Division of Pediatric Cardiology, NYU Langone School of Medicine, New York, New York.*

Introduction

Ivabradine, a novel heart rate–reducing agent, acts via selective inhibition of the funny current responsible for spontaneous depolarization of cardiac pacemaker cells. Ivabradine is currently FDA approved to reduce hospitalizations in adults with stable heart failure, and is also commonly used for the treatment of inappropriate sinus tachycardia.[1]

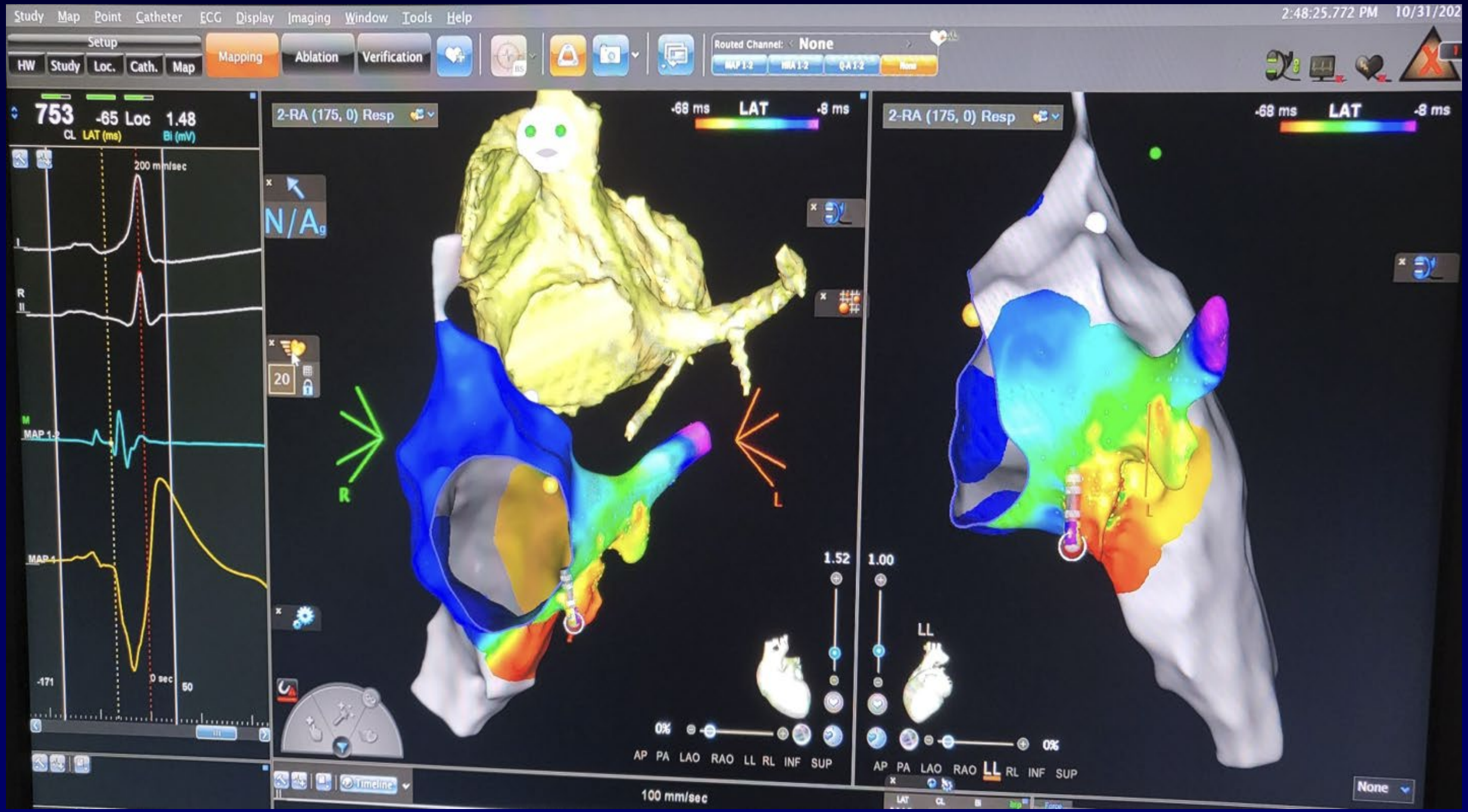
Isolated case reports and a few case series suggest a promising role for ivabradine in the treatment of pediatric tachyarrhythmias.[2–5] Increased automaticity is the underlying mechanism of several pediatric tachyarrhythmias, including junctional ectopic tachycardia (JET) and ectopic atrial tachycardia (EAT). By inhibition of the funny current and reduction of automaticity, ivabradine represents a plausible potential therapy for these conditions. Ivabradine's relatively hemodynamically neutral profile makes it an attractive antiarrhythmic agent.

In this case series, we report on the use of ivabradine in the treatment of automatic tachyarrhythmias in 4 children and young adults with diverse arrhythmia substrates, but with a common mechanism of increased automaticity. We have found ivabradine to be safe in all patients, with efficacy in 3 out of 4 patients treated.

KEY TEACHING POINTS

- Ivabradine is a novel heart rate–reducing agent that acts via selective inhibition of the pacemaker current.
- Ivabradine demonstrates use dependence, resulting in a greater effect at higher heart rates.
- Ivabradine has a hemodynamically neutral profile, in contrast to many alternative antiarrhythmic agents.
- Ivabradine shows promise as an effective treatment for automatic tachyarrhythmias in pediatric and congenital heart disease patients.

ventricular rate was only 120 beats/min on average. Echocardiogram demonstrated normal anatomy and function. A trial of intravenous (IV) esmolol (as high as 150 mcg/kg/min) had no effect on the atrial tachycardia. Esmolol was discontinued, and ivabradine was started at a dose of 1.25 mg orally (PO) twice daily (BID) (0.05 mg/kg/day). Approximately 90 minutes after the first dose, the tachycardia terminated to sinus


Study Map Point Catheter ECG Display Imaging Window Tools Help
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Setup
HW Study Loc. Cath. Map
Mapping
Ablation
Verification
Routed Channel: None
753 -65 Loc 1.48
CL LAT (ms) Bi (mV)
200 mm/sec
MAP 1-2
MAP 1
-171
0 sec
50
2-RA (175, 0) Resp
-68 ms LAT -8 ms
N/A
20
R
L
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0%
AP PA LAO RAO LL RL INF SUP
Timeline
100 mm/sec
2-RA (175, 0) Resp
-68 ms LAT -8 ms
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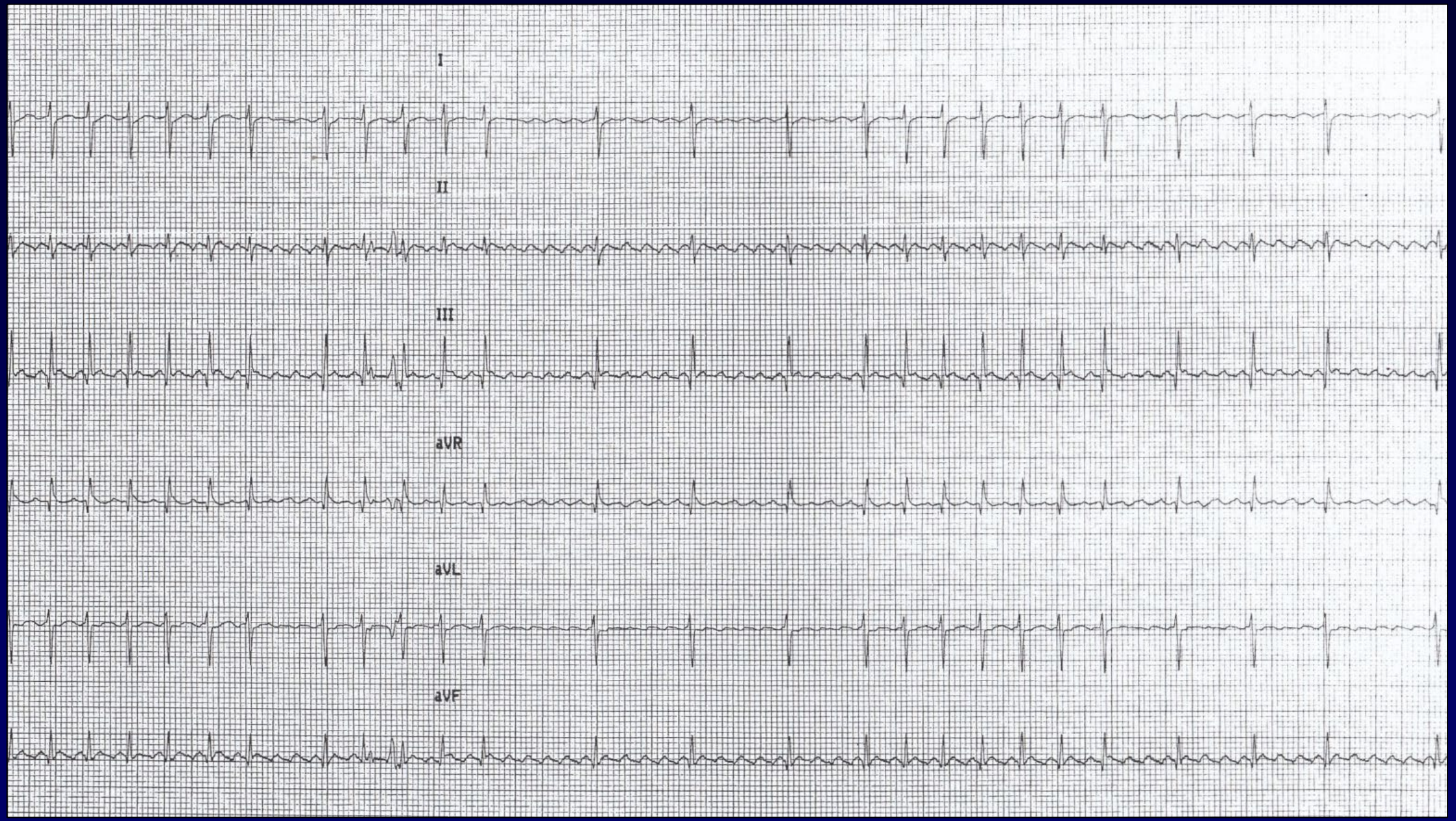
LL
0%
AP PA LAO RAO LL RL INF SUP
None

FLUTTER ATRIALE



TACHICARDIA VENTRICOLARE

"**Sudden cardiac death (SCD)** among children and young adults is a devastating event for the family and wider community"

Bagnall RD, NEJM 2016

TACHICARDIA VENTRICOLARE
Terapia dell'attacco acuto

Propafenone

- bolo: 0,5-1,5 mg/kg
- effetti collaterali: depressione funzione VS, allargamento QRS

Flecainide

- bolo: 1 mg/kg
- effetti collaterali: depressione funzione VS, allargamento QRS

Adenosina (solo tachicardia infundibolare!)

- bolo: 100-150 γ /kg, da raddoppiare fino a un max di 300 **γ/kg**
- effetti collaterali: blocco A-V, broncospasmo, etc

Verapamil (tachicardia fascicolare)

- bolo: 0,1 mg/kg
- mantenimento: 0,001-0,005 mg/kg/m'
- effetti collaterali: ipotensione, asistolia (controindicato nel 1° anno, eccetto in casi particolari)

Amiodarone

- Farmaco antiaritmico della classe III con caratteristiche di tutte e quattro le classi
- Da usare nel trattamento delle TSV resistenti o nel trattamento delle tachicardie ventricolari emodinamicamente stabili
- Dose d'attacco: 5 mg/Kg in 20-60 min.
- **Dose di mantenimento: 10-20 mg/Kg nelle 24 ore in destrosio al 5% o in soluzione fisiologica per evitare la precipitazione**
- Opportuno monitorare la pressione arteriosa per i potenti effetti α bloccanti di tale farmaco

Lidocaina

- Farmaco antiaritmico della classe Ib e quindi un bloccante i canali del sodio che deprime la depolarizzazione ventricolare senza azione sul nodo seno-atriale o AV.
- Sopprime le extrasistoli ventricolari nei pazienti a rischio di ricorrenti e subentranti crisi di TV minacciosa ma è anche in grado di convertire una TV in ritmo sinusale nel 20% dei casi.
- **Dose ev di attacco: 0.5-2 mg/kg in 1-2 minuti, ripetibile ogni 10 minuti senza superare 3 mg/Kg**
- **Dose di mantenimento in infusione continua di 0.02-0.05 mg/kg/m. (effetti collaterali sul SNC)**

Conditions Associated with Ventricular Tachycardia in Young Patients

Congenital Myopathy
- Hypertrophic cardiomyopathy
- Carnitine deficiency
- Storage diseases
- Muscular dystrophy
- "Familial" myopathy

Acquired Myopathy
- Myocarditis (acute or remote)
- Adriamycin cardiotoxicity
- HIV infection
- Hemochromatosis
- Idiopathic dilated myopathy

Anatomic Cardiac Defects (before and/or after surgery)
- Tetralogy of Fallot
- Aortic stenosis
- Transposition (D and L forms)
- Ventricular septal defect
- Single ventricle
- Right ventricular dysplasia
- Mitral valve prolapse
- Cardiac tumors

Primary Electrical Disorders
- Prolonged Q-T (congenital and acquired)
- Diffuse conduction system disease
- Bradycardia conditioned (sick sinus and heart block)
- Idiopathic VT

Coronary Artery Disease
- Vasculitis
- Anomalous origin of left coronary from pulmonary artery
- Compression due to aberrant course of coronary off aorta
- Kawasaki's disease

Intoxications and Exposures
- Digoxin toxicity
- Antiarrhythmic drugs (class I and III)
- Tricyclic antidepressant overdose
- Organophosphate exposure
- Substance abuse

Terapia della TV nella LQTS … oltre a quanto detto in precedenza

Durante la fase di stabilità aritmica…

- Correzione dell'eventuale **ipokaliemia**
- Eventuale **overdrive pacing** mediante stimolazione transesofagea (FC > 150 bpm) nella prevenzione della TdP
- Posizionamento placche pediatriche/neonatali (anche A-P) del **defibrillatore**, acceso e con J settati in relazione ai Kg

Congenital long QT syndrome and 2:1 atrioventricular block: An optimistic outcome in the current era

Peter F. Aziz, MD, Ronn E. Tanel, MD,* Ilana J. Zelster, MD,† Robert H. Pass, MD,‡
Tammy S. Wieand, MS, Victoria L. Vetter, MD, R. Lee Vogel, MD, Maully J. Shah, MBBS

*From the Division of Cardiology, Children's Hospital of Philadelphia, University of Pennsylvania School of Medicine, Philadelphia, Pennsylvania, *Division of Pediatric Cardiology, UCSF Children's Hospital and Department of Pediatrics, UCSF School of Medicine, San Francisco, California, †Division of Cardiology, Children's Medical Center, Dallas, Texas, and ‡Division of Cardiology, Children's Hospital at Montefiore and Albert Einstein College of Medicine, Bronx, New York.*

Heart Rhythm, 2010

- **Esmololo** ev in IC a 100-300 mcg/Kg/min (con attento monitoraggio della PA!)

SINDROME DI BRUGADA

General recommendations		
The following is recommended in all patients with BrS: (a) Avoidance of drugs that may induce ST-segment elevation in right precordial leads (http://www.brugadadrugs.org). (b) Avoidance of cocaine, cannabis, and excessive alcohol intake. (c) Treatment of fever with antipyretic drugs.	I	C

Risk stratification, prevention of SCD and treatment of VA		
ICD implantation is recommended in patients with BrS who: (a) Are survivors of an aborted CA and/or (b) Have documented spontaneous sustained VT.[980,990–992]	I	C
ICD implantation should be considered in patients with type 1 Brugada pattern and an arrhythmic syncope.[990,992,996]	IIa	C
Implantation of a loop recorder should be considered in BrS patients with an unexplained syncope.[997,999]	IIa	C
Quinidine should be considered in patients with BrS who qualify for an ICD but have a contraindication, decline, or have recurrent ICD shocks.[922,1006,1007]	IIa	C
Isoproterenol infusion should be considered in BrS patients suffering electrical storm.[1008]	IIa	C
Catheter ablation of triggering PVCs and/or RVOT epicardial substrate should be considered in BrS patients with recurrent appropriate ICD shocks refractory to drug therapy.[1010–1015]	IIa	C

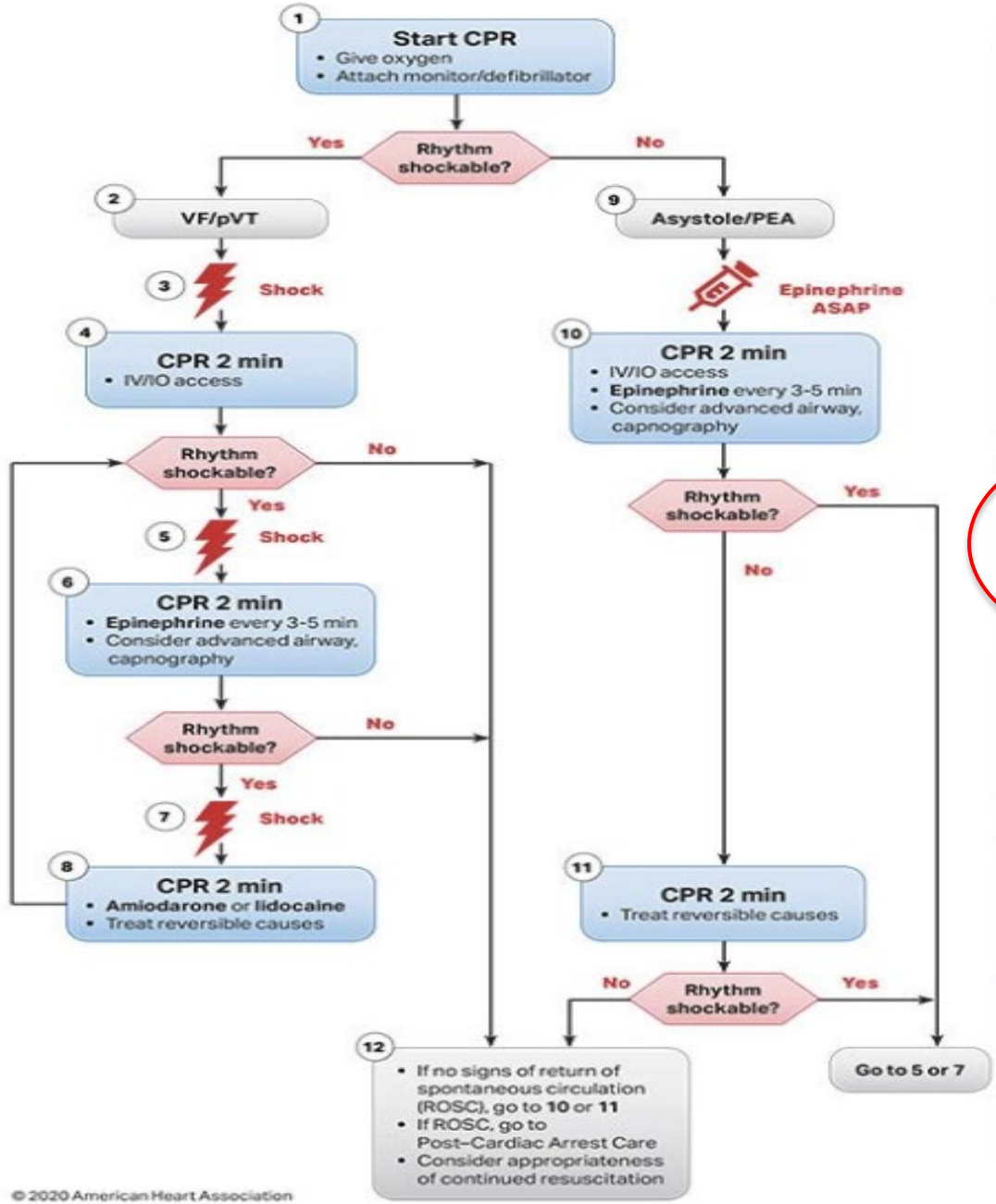
Raccomandazioni generali

Evitare farmaci che posso indurre elevazione del segmento ST nelle precordiali destre (www.brugadadrugs.org)
Evitare cocaina, cannabis e eccessivo uso di alcool
Trattare prontamente la febbre

Chinidina dovrebbe essere considerata in pazienti con Brugada che
non accettano ICD o
in cui l' ICD è controindicato o
dove presente ICD ma con shocks ricorrenti

Isoproterenolo dovrebbe essere considerata in pazienti con Brugada con storm aritmico

Adult Cardiac Arrest Algorithm (VF/pVT/Asystole/PEA)



CPR Quality

- Push hard (at least 2 inches [5 cm]) and fast (100-120/min) and allow complete chest recoil.
- Minimize interruptions in compressions.
- Avoid excessive ventilation.
- Change compressor every 2 minutes, or sooner if fatigued.
- If no advanced airway, 30:2 compression-ventilation ratio.
- Quantitative waveform capnography
  - If P_{ETCO_2} is low or decreasing, reassess CPR quality.

Shock Energy for Defibrillation

- **Biphasic:** Manufacturer recommendation (eg, initial dose of 120-200 J); if unknown, use maximum available. Second and subsequent doses should be equivalent, and higher doses may be considered.
- **Monophasic:** 360 J

Drug Therapy

- **Epinephrine IV/IO dose:** 1 mg every 3-5 minutes
- **Amiodarone IV/IO dose:** First dose: 300 mg bolus. Second dose: 150 mg.
  or
  Lidocaine IV/IO dose: First dose: 1-1.5 mg/kg. Second dose: 0.5-0.75 mg/kg.

Advanced Airway

- Endotracheal intubation or supraglottic advanced airway
- Waveform capnography or capnometry to confirm and monitor ET tube placement
- Once advanced airway in place, give 1 breath every 6 seconds (10 breaths/min) with continuous chest compressions

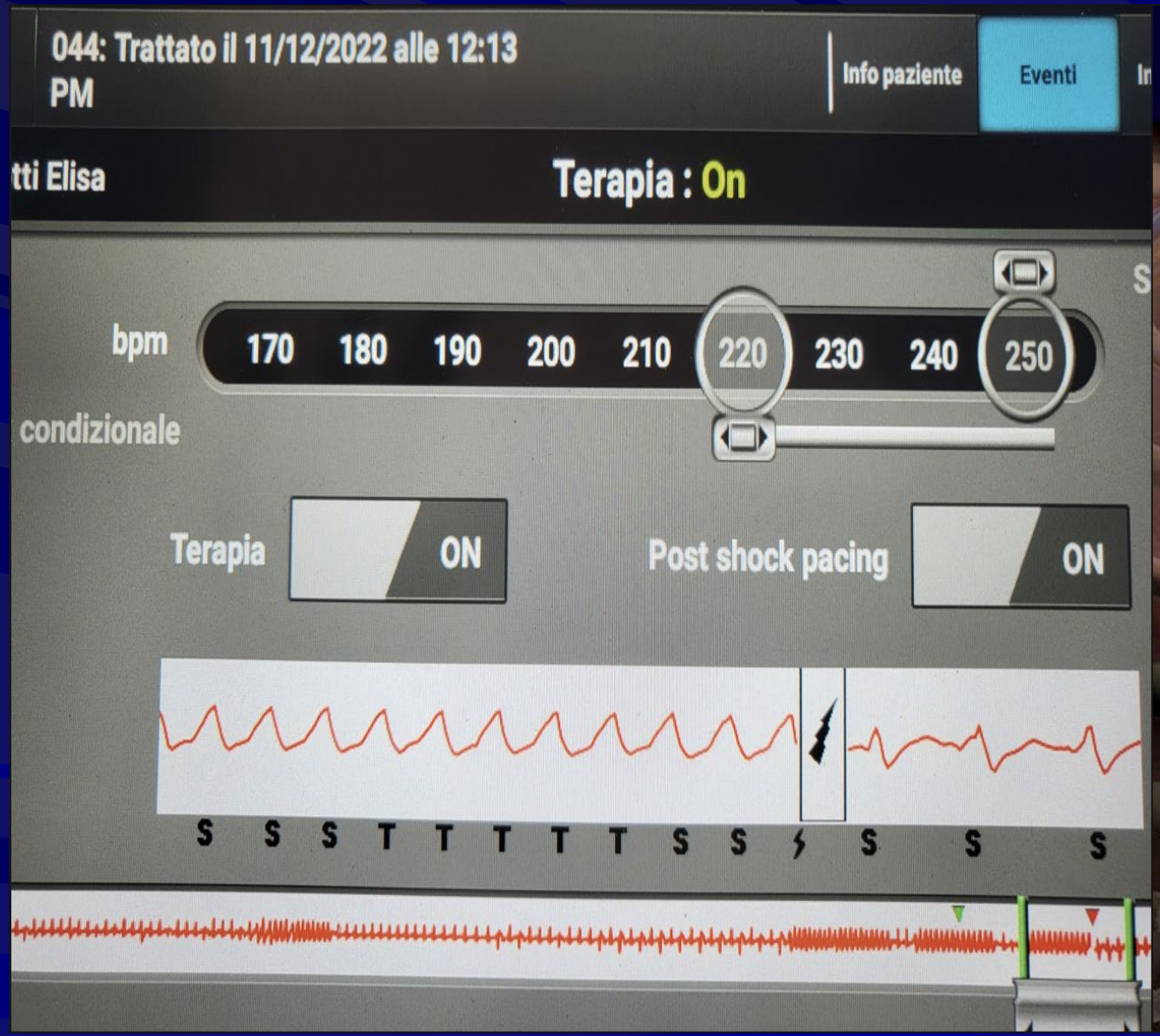
Return of Spontaneous Circulation (ROSC)

- Pulse and blood pressure
- Abrupt sustained increase in P_{ETCO_2} (typically ≥40 mm Hg)
- Spontaneous arterial pressure waves with intra-arterial monitoring

Reversible Causes

- **H**ypovolemia
- **H**ypoxia
- **H**ydrogen ion (acidosis)
- **H**ypo-/hyperkalemia
- **H**ypothermia
- **T**ension pneumothorax
- **T**amponade, cardiac
- **T**oxins
- **T**hrombosis, pulmonary
- **T**hrombosis, coronary

Gli ICD…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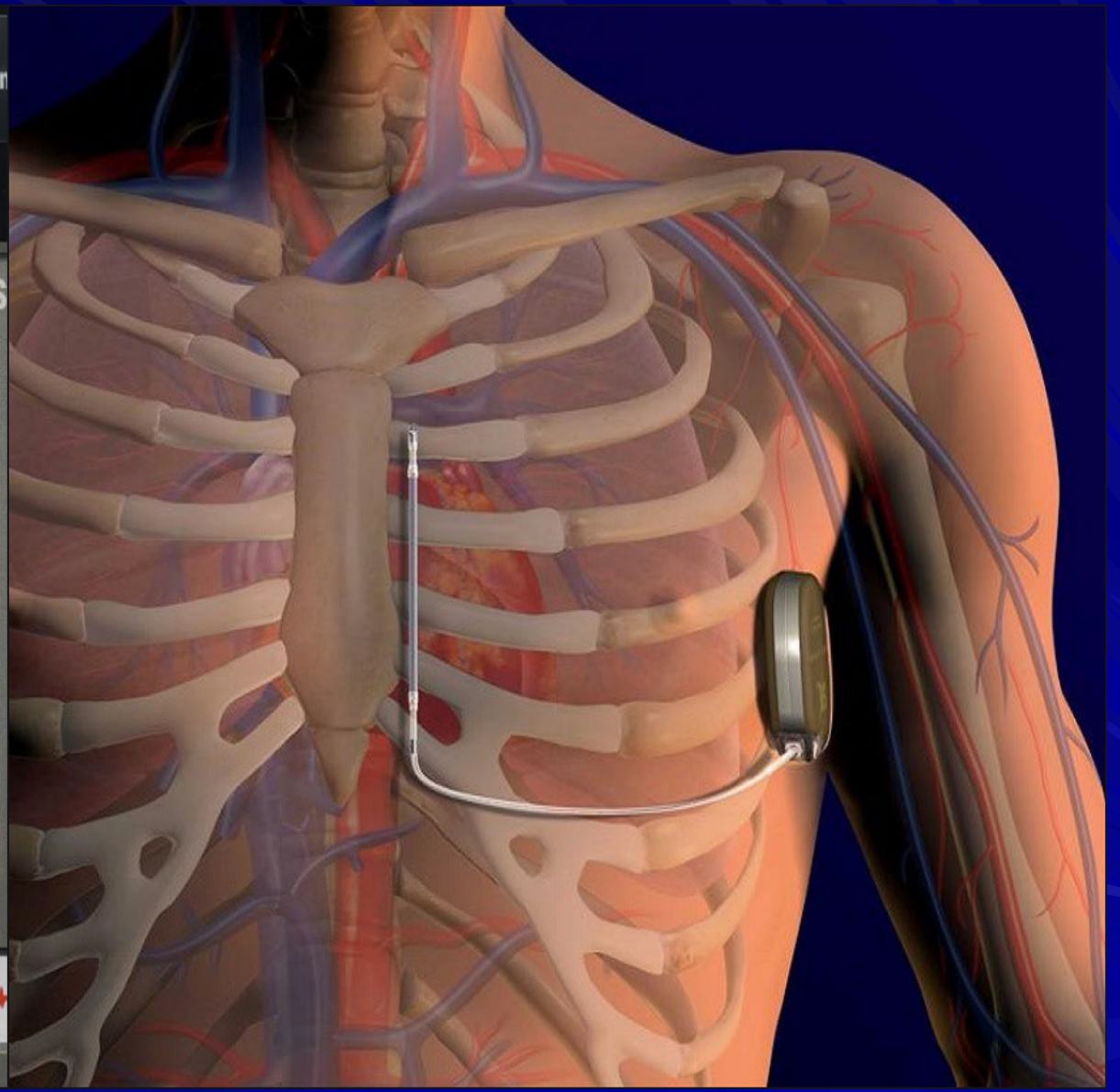
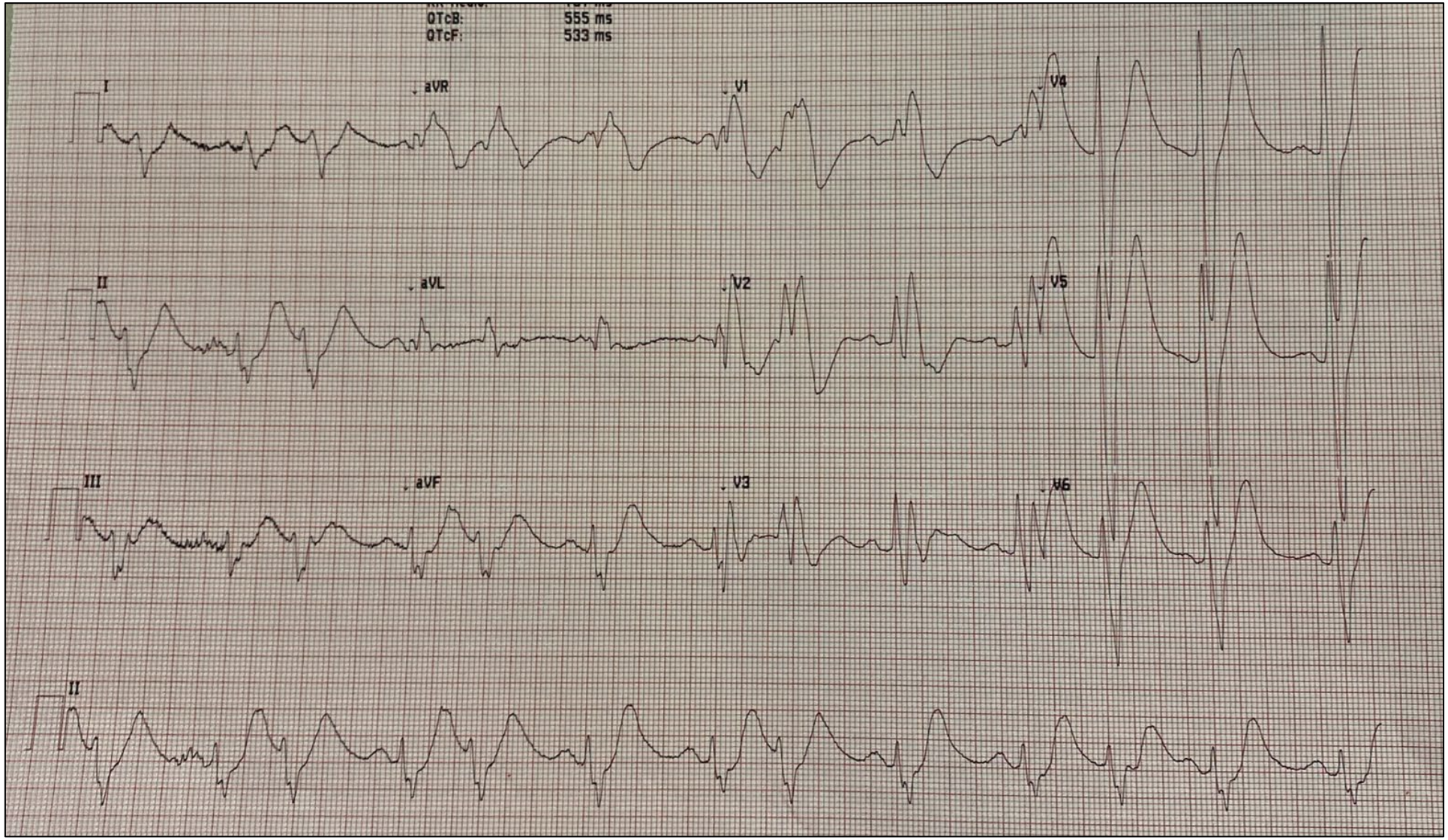
PM
Info paziente
Eventi
tti Elisa
Terapia : On
bpm
170 180 190 200 210 220 230 240 250
condizionale
Terapia
ON
Post shock pacing
ON
S S S T T T T T S S S S S



Antiaritmici in età pediatrica
Rischio di intossicazione…



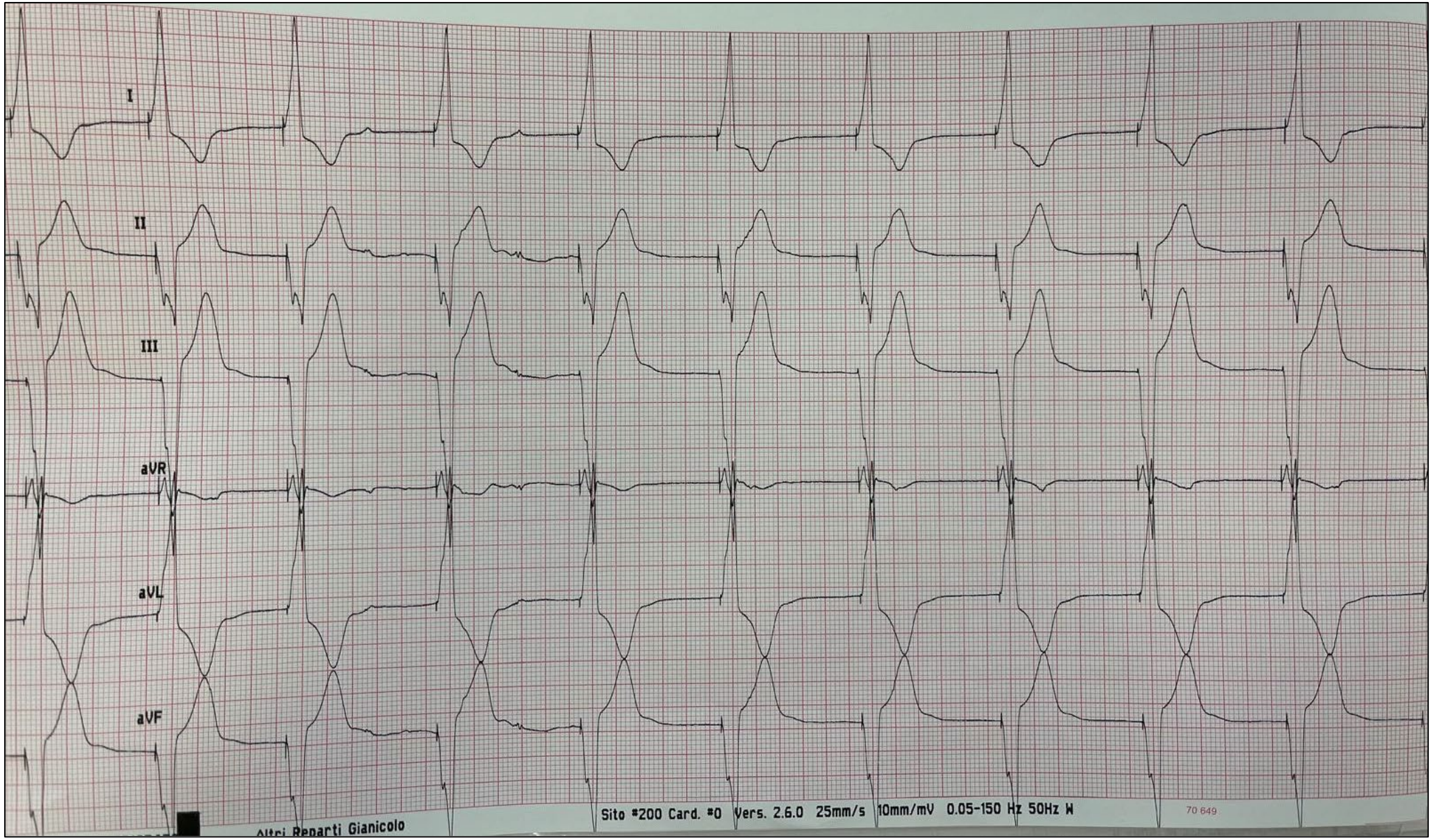
Neonatal and Pediatric Arrhythmias

Clinical and Electrocardiographic Aspects

Fabrizio Drago, MD*, Irma Battipaglia, MD,
Corrado Di Mambro, MD

La terapia «in acuto» del BAV…

- Atropina alla dose ev di 0.02 mg/kg (avvertendo il bambino, che naturalmente è in grado di comprendere, dei noti e transitori effetti collaterali come la secchezza delle fauci e i disturbi visivi)
- Isoproterenolo alla dose di 0.1 µg/kg/min.
- Stimolazione temporanea (epicardica o transvenosa)


I
II
III
aVR
aVL
aVF
Sito #200 Card. #0 Vers. 2.6.0 25mm/s 10mm/mV 0.05-150 Hz 50Hz W
70 649
Altri Reparti Gianicolo

Grazie per l'attenzione!

corrado.dimambro@opbg.net