

2009 Unit-Based Competencies

Alameda County Medical Center
Highland Hospital

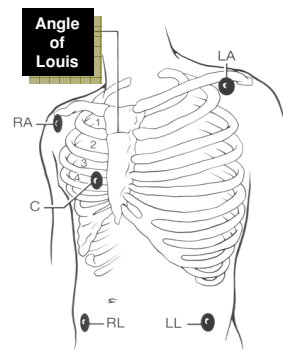
Emergency Department

Janis Farnholtz Provinse, RN, MS, CNS, CEN, ED Clinical Nurse Specialist

CELEBRATING THE 100TH BIRTHDAY OF THE ELECTROCARDIOGRAM: LESSONS LEARNED FROM RESEARCH IN CARDIAC MONITORING

By Barbara J. Drew, RN, PhD. From the Department of Physiological Nursing, University of California, San Francisco. Distinguished Research Lecture presented at the American Association of Critical-Care Nurses National Teaching Institute, May 6, 2002, Atlanta, Ga.

“Nurses play a pivotal role in placing electrodes accurately, ensuring consistent lead placement over time, and assessing and responding appropriately to alarms that indicate arrhythmia and ischemia.”



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ECG Lead Placement

The V lead may be placed in any of the V lead locations (V1 - V6, etc.)

- White on the right, smoke (black) over fire (red)
- Grass (green) under snow (white)
- Chocolate (brown) close to the heart – can go in any V lead location
- Best leads for monitoring patients with **chest pain, R/O MI, ACS**
 - Lead II or III & V3 &/or the lead with the biggest ST changes
- Best leads for monitoring patients with **c/o arrhythmias**
 - Lead II or III and V1

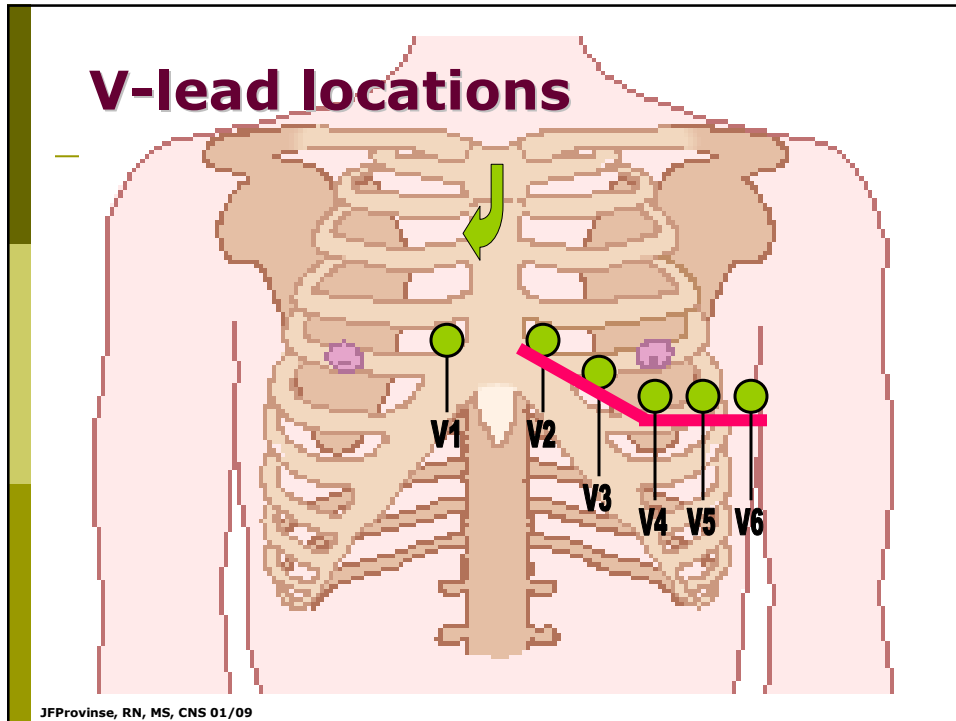
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Electrode Placement



V1	4 th ICS right sternal border
V2	4 th ICS left sternal border
V3	In between V ₂ and V ₄
V4	5 th ICS mid-clavicular line
V5	In between V ₄ and V _{6r} anterior axillary line
V6	Straight across from V ₄ and V _{5r} mid-axillary line
R&L arms	At least 10cm from heart, anywhere on the extremity – avoid bone
R&L legs	

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Interpreting the J-point & ST-segment

- **J-point**
 - Junction between the QRS complex and the ST segment
 - Used to evaluate ST segment elevation or depression
- **ST-segment derangements**
 - Measured 0.04 seconds out from j-point
 - 1 mm of elevation or depression is considered abnormal

J Point

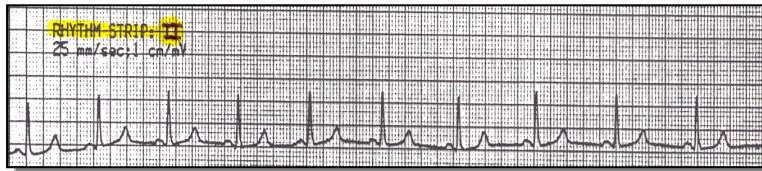
5 mm depression

4 mm elevation

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The Importance of Proper ECG Lead Selection

- 36 year old male post-op PACU pt
- Somnolent from drugs received in OR
- Complaining of left shoulder pain
- History of left shoulder pain
- Monitored in Lead II



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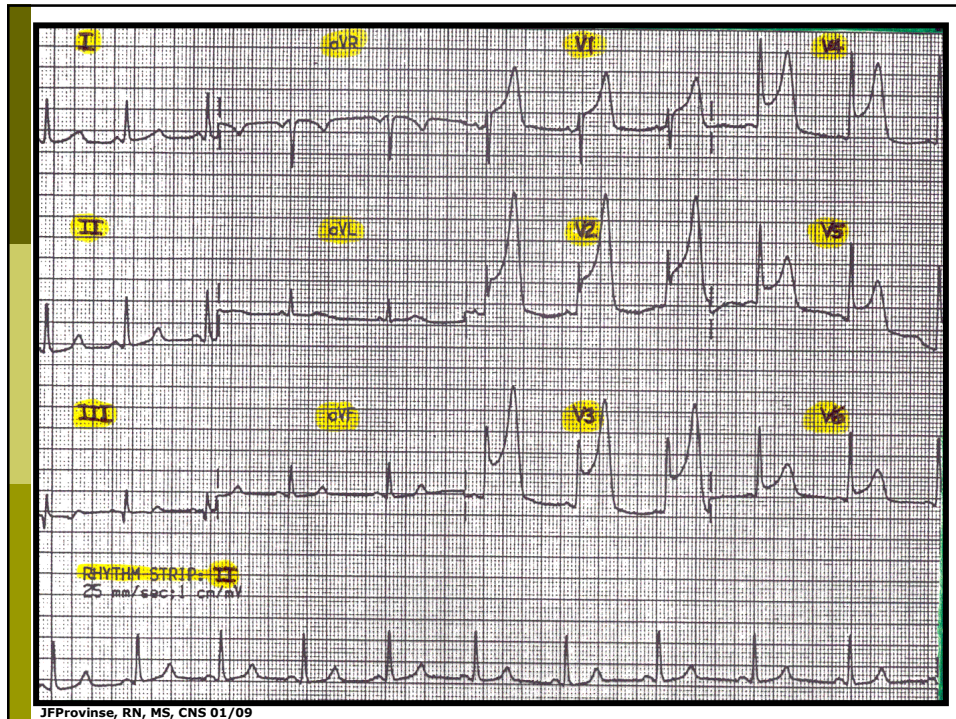
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Patient Course . . .

- Sinus Rhythm in lead II
- Nurses say, "it can't be cardiac, his rhythm looks great on the monitor"
- BP drops . . . fluid bolus . . . BP continues to drop . . . more fluid
- He goes into pulmonary edema
- He crashes . . . he's intubated
- Someone decides to do a 12-lead EKG



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ST SEGMENT MONITORING WITH A DERIVED 12-LEAD ELECTROCARDIOGRAM IS SUPERIOR TO ROUTINE CARDIAC CARE UNIT MONITORING

By Barbara J Drew, RN, PhD, Mary G Adams, RN, MS, Michele M Pelter, RN, MS, and Shu-Fen Wung, RN, MS. From the Department of Physiological Nursing, University of California, San Francisco, Calif.


"We found that the best ECG leads for detecting ischemia related to specific coronary arteries were as follows:

- right coronary artery, lead III**
- left anterior descending artery, lead V3**
- left circumflex artery, also lead V3**

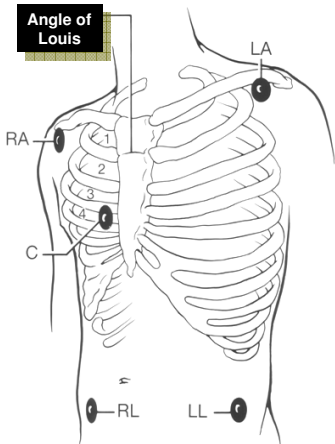
Thus, if the goal of monitoring is primarily to detect ischemia, the dual-lead combination of III and V3 may be most efficacious for systems that do not provide full 12-lead ECG monitoring."

Drew 2002

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DYSRHYTHMIA MONITORING



From Philips Cardiac Monitoring Pocket Card 2002

- **Lead V₁**
 - **Best at differentiating between ventricular dysrhythmias**
 - VT vs SVT with aberrant conduction
 - Right vs Left BBB
 - **It is the lead of choice for dysrhythmia monitoring**
 - **Precordial leads misplaced by 1 ICS can change the QRS morphology**
- **Lead II or III**
 - **Best at identifying atrial dysrhythmias**
 - For example afib and aflutter

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AACN 4/2008

AHA Scientific Statement

Practice Standards for Electrocardiographic Monitoring in Hospital Settings

An American Heart Association Scientific Statement From the Councils on Cardiovascular Nursing, Clinical Cardiology, and Cardiovascular Disease

The goals of ECG monitoring in hospital settings have expanded from simple heart rate & basic rhythm determination to the diagnosis of complex arrhythmias, myocardial ischemia, and prolonged QT interval.

Barbara J. Drew, RN, PhD, Chair; Robert M. Califf, MD; Marjorie Funk, RN, PhD; Elizabeth S. Kaufman, MD; Mitchell W. Krucoff, MD; Michael M. Laks, MD; Peter W. Macfarlane, DSc, FRCP; Claire Sommargren, RN, PhD; Steven Swiryn, MD; George F. Van Hare, MD

Abstract—The goals of electrocardiographic (ECG) monitoring in hospital settings have expanded from simple heart rate and basic rhythm determination to the diagnosis of complex arrhythmias, myocardial ischemia, and prolonged QT interval. Whereas computerized arrhythmia analysis is automatic in cardiac monitoring systems, computerized ST-segment ischemia analysis is available only in newer-generation monitors, and computerized QT-interval monitoring is currently unavailable. Even in hospitals with ST-monitoring capability, ischemia monitoring is vastly underutilized by healthcare professionals. Moreover, because no computerized analysis is available for QT monitoring, healthcare professionals must determine when it is appropriate to manually measure QT intervals (eg, when a patient is started on a potentially proarrhythmic drug). The purpose of the present review is to provide ‘best practices’ for hospital ECG monitoring. Randomized clinical trials in this area are almost nonexistent; therefore, expert opinions are based upon clinical experience and related research in the field of electrocardiography. This consensus document encompasses all areas of hospital cardiac monitoring in both children and adults. The emphasis is on information clinicians need to know to monitor patients safely and effectively. Recommendations are made with regard to indications, timeframes, and strategies to improve the diagnostic accuracy of cardiac arrhythmia, ischemia, and QT-interval monitoring. Currently available ECG lead systems are described, and recommendations related to staffing, training, and methods to improve quality are provided. (*Circulation*. 2004;110:2721-2746.)

Key Words: AHA Scientific Statements ■ pediatrics ■ electrocardiography ■ torsade de pointes ■ myocardial infarction ■ tachyarrhythmias ■ ischemia ■ antiarrhythmic agents ■ long-QT syndrome


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(*Circulation*. 2004;110:2721-2746.)

V_1		V_6 or MCL_6
VENTRICULAR		
Monophasic R		Biphasic rS with R:S ratio < 1.0
Taller left peak		Monophasic Q
Biphasic RS		Notched QS
Biphasic qR		Biphasic qR
Any one of the following in V_1 or V_2 : (a) R > 30 ms (b) Slurred or notched S descent (c) QRS onset to S nadir > 60 ms		Intrinsicoid deflection ≥ 70 ms
SUPRAVENTRICULAR with BUNDLE BRANCH BLOCK or ABERRATION		
Bimodal rR' or Triphasic rSR'		Triphasic qRs with R:S ratio > 1.0
All of the following in V_1 or V_2 : (a) R ≤ 30 ms or no R (b) Straight S descent (c) QRS onset to S nadir ≤ 60 ms And, no Q in V_6		Intrinsicoid deflection ≤ 50 ms
UNHELPFUL QRS MORPHOLOGIES		
Slurred or notched taller right peak		Monophasic R
		Taller left or right peak
		Biphasic Rs with R:S ratio > 1.0

* Applies only to tachycardias with a positive waveform in V_1


Importance of Lead Placement

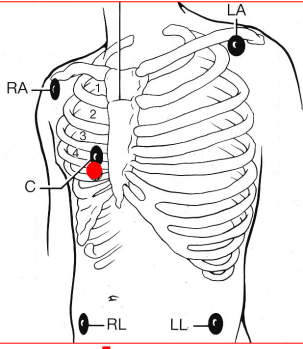
- VT = taller left peak in V_1
- SVT with aberrancy = taller right peak in V_1

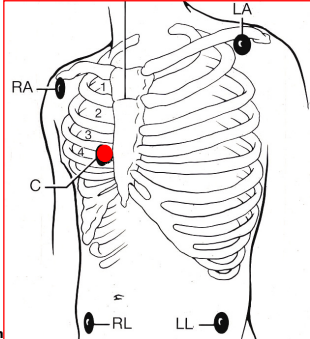


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A.





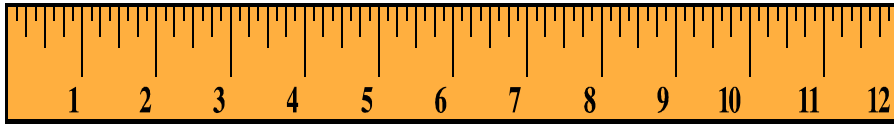


B.



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Stickers placed even one rib space lower or higher than the correct normal placement can misleadingly diagnose myocardial infarction, hypertrophy, or SVT with aberrancy vs VT.

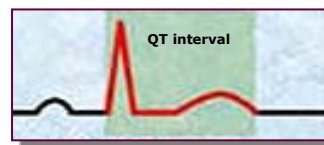
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QT Interval & ECG Monitoring for Detection of Proarrhythmia

Introduction

- The QT interval is an indirect measure of ventricular repolarization
- Increases in QT interval are associated with an increased risk of syncope and sudden death from torsades de pointes and VT
- Clinical situations that may lead to QT prolongation include:
 - QT prolonging drugs, ischemia/infarction, electrolyte disorders, sudden decreases in heart rate, acute neurologic events



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Drew et al 2004

Measuring the QT Interval

- Measure from the beginning of the QRS complex to the end of the T wave
 - Normal QTc is <0.46 seconds in woman
 - Normal QTc is <0.45 seconds in men
 - A QTc >0.50 sec (or 500 msec) in either sex has been shown to correlate with a higher risk for torsades de pointes

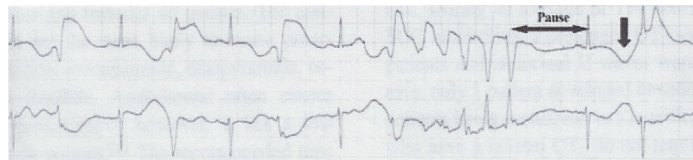
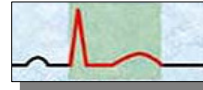


Figure 2. Arrhythmias associated with prolonged QT interval that place patient at immediate risk for developing torsades de pointes. ECG characteristics include underlying prolonged QT interval, T wave alternans, polymorphic ventricular premature beats that fall near T-U portion of repolarization, pause-dependent enhancement of QT interval (arrow), and nonsustained polymorphic ventricular tachycardia.

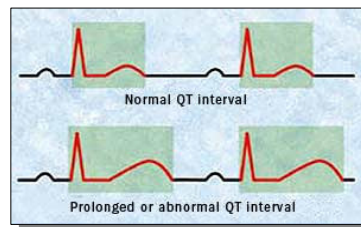
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Measuring the QT Interval

- The most commonly used QT correction formula in clinical practice is Bazett's formula
 - $QT_c = QT \text{ interval divided by the square root of the R-R interval measured in seconds}$
 - The EKG machine does this for us (QT/QTc) – it prints out as the second number at the top of the 12 lead – normal QTc is <500 msec

$$QT_c = \frac{QT}{\sqrt{RR}}$$



- The Quick Way – when you don't have a 12-lead:
Normal QT = less than 1/2 the R-R interval

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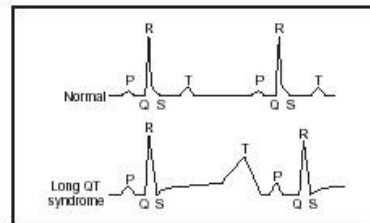
QT Interval & ECG Monitoring for Detection of Proarrhythmia

Class I Recommendations

- Which patients should be monitored for prolonged QT intervals?
 - Those administered an antiarrhythmic drug known to cause Torsades de Pointes
 - Those with an overdose from a potentially proarrhythmic agent
 - Those with new-onset bradyarrhythmias
 - Those with severe hypokalemia or hypomagnesemia
 - *If you plan to draw labs to see if your patient's electrolytes are "out of whack", do a 12-lead & look at the QTc -*
 - Is the QTc greater than 500 msec?
 - If so, inform the MD & place the patient on a cardiac monitor

☺ The Easy Way ☺ to remember QT Abnormalities

QTc > .50 sec = abnormal
 QT > 50% = abnormal
 (.50sec = 500msec)

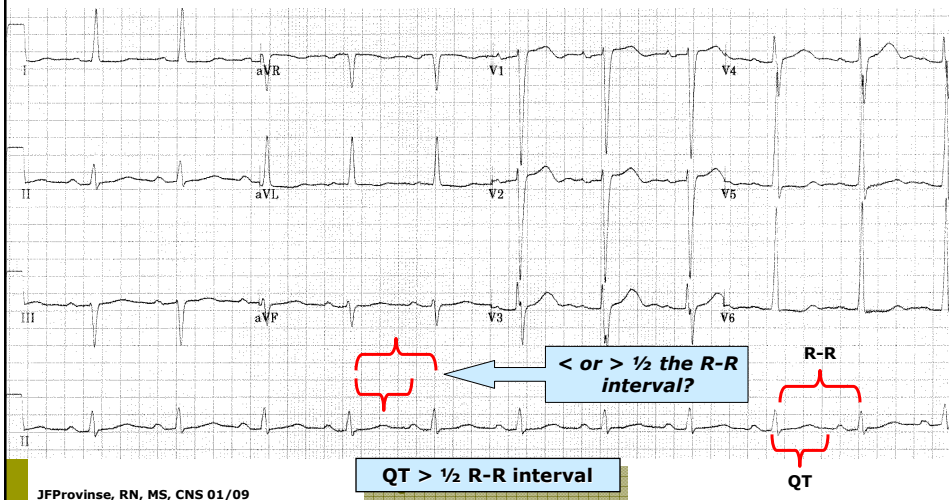


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Case Study

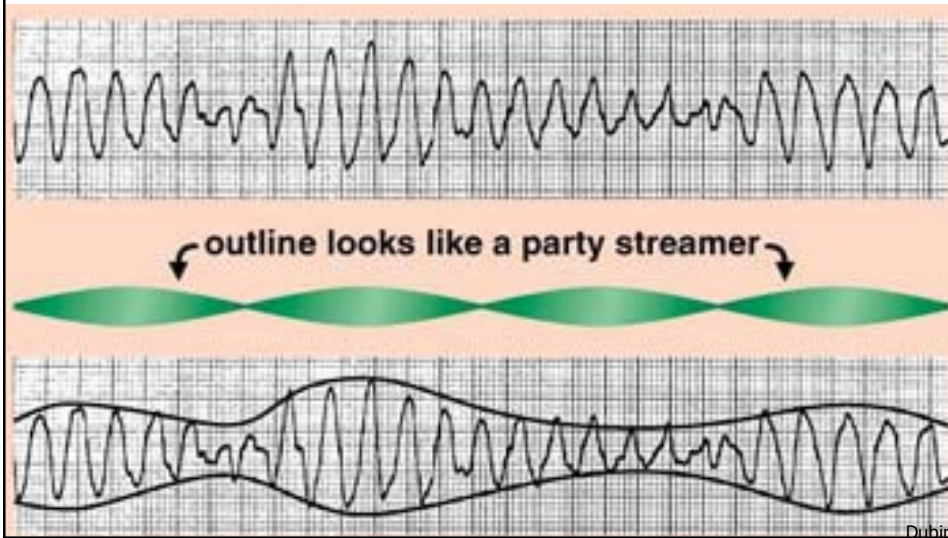
91 year old woman on an Amiodarone drip for ~27 hours
 Drip had been stopped then restarted due to "runs of VT"
 What is your interpretation of her rhythm?



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Case Study

Review of her event history on the cardiac monitor showed the pattern pictured below. What's your impression now?



Common Drugs that Prolong the QT Interval

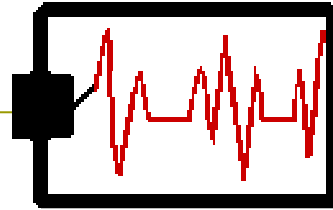


- ❑ Amiodarone
- ❑ Droperidol
- ❑ Erythromycin
- ❑ Haldol
- ❑ Methadone

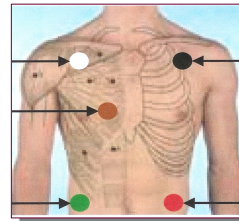
- ❑ Azithromax
- ❑ Levaquin
- ❑ Zofran
- ❑ Geodon
- ❑ *And many more!**

Which have you given in the past month?
 Did you evaluate the patient's QT &/or QTc before, during, or after administration?

Cardiac Monitoring: *The Standard*



- What are the best leads for monitoring a patient with Chest Pain / STEMI, NSTEMI, USA?
 - Leads III or II and V₃ initially
 - Leads that show the greatest ST changes
- What are the best leads for monitoring a patient with Arrhythmias / "Palpitations"?
 - Leads III or II and V₁
- What are the best leads for monitoring all other patients on cardiac monitors?
 - Leads III or II and V₁



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Pop Quiz!

- What is the correct location of the brown electrode for a patient with c/o CP & no current ST changes on the 12 lead EKG?
- T or F? The red & green electrodes should be placed below the rib cage (minimally) or below the umbilicus.
- What is considered to be an abnormally prolonged QTc &/or QT interval?
- What is a complication of a prolonged QT?
- How many mm of ST ↑ or ↓ is abnormal?

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