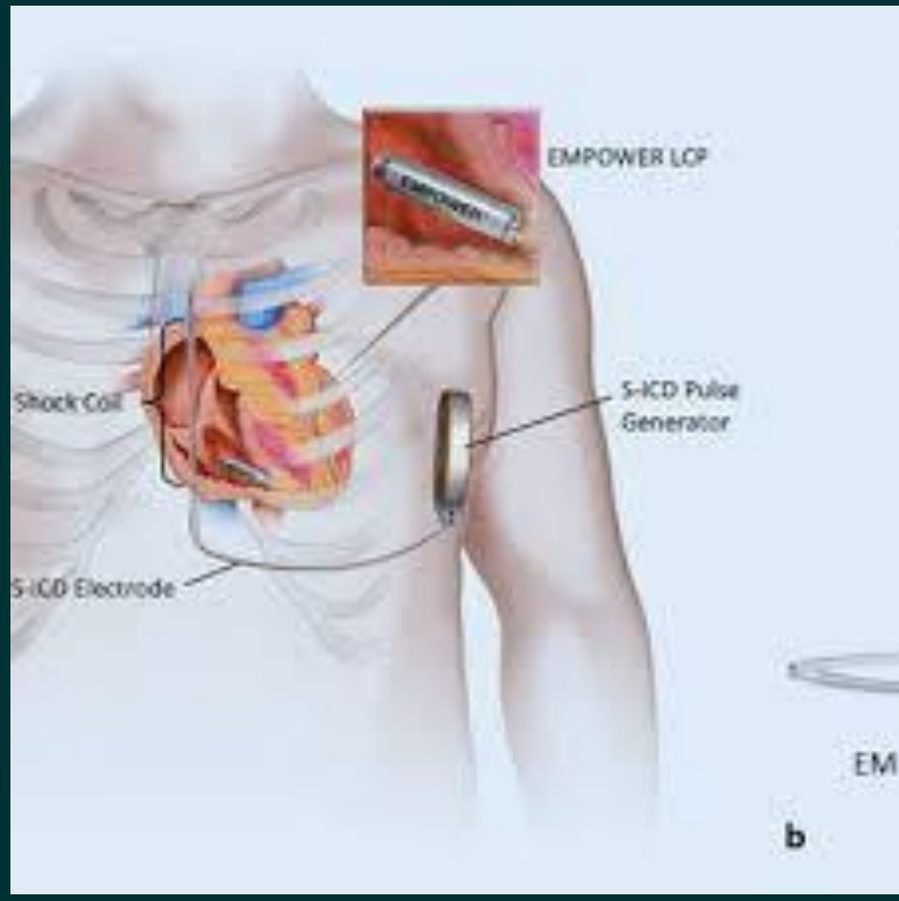
S-ICD



subcutaneous implantable cardioverter-defibrillator

AA Hendriks

Inhoud

- verschil T-ICD / S-ICD
- selectie patiënten voor S-ICD
  - vector bepaling
- procedure /techniek
- complicaties
- sensing
- therapie
- programming
- trouble shoot
- literatuur

ICD

- Wat doet een ICD
  - voorkomen van plotse hartdood
  - geeft therapie op VT en VF
- Indicaties
  - primaire preventie
  - secundaire preventie

Transvenous ICD vs S-ICD

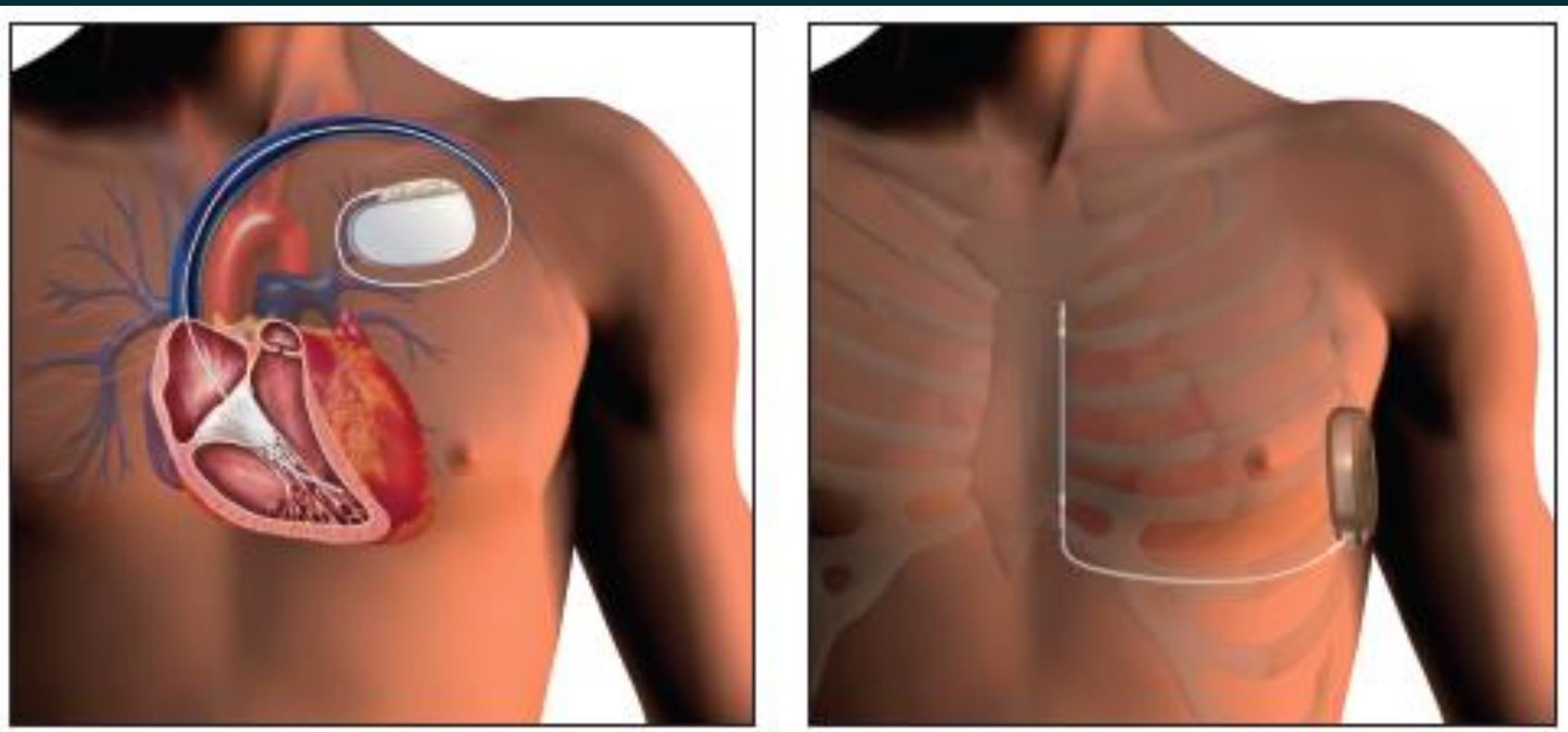


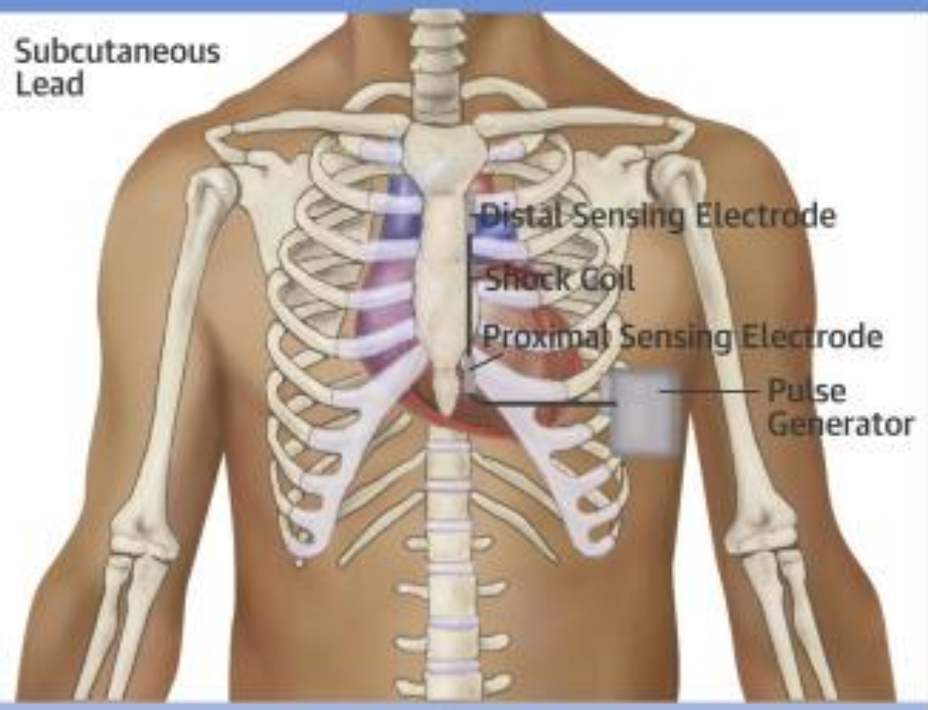
Figure 3: Implantable Defibrillator Options. At left: Transvenous ICD System (electrical wires placed through the veins into the heart). At right: Subcutaneous S-ICD™ System (electrode placed under the skin with nothing inside the heart).

Verschil

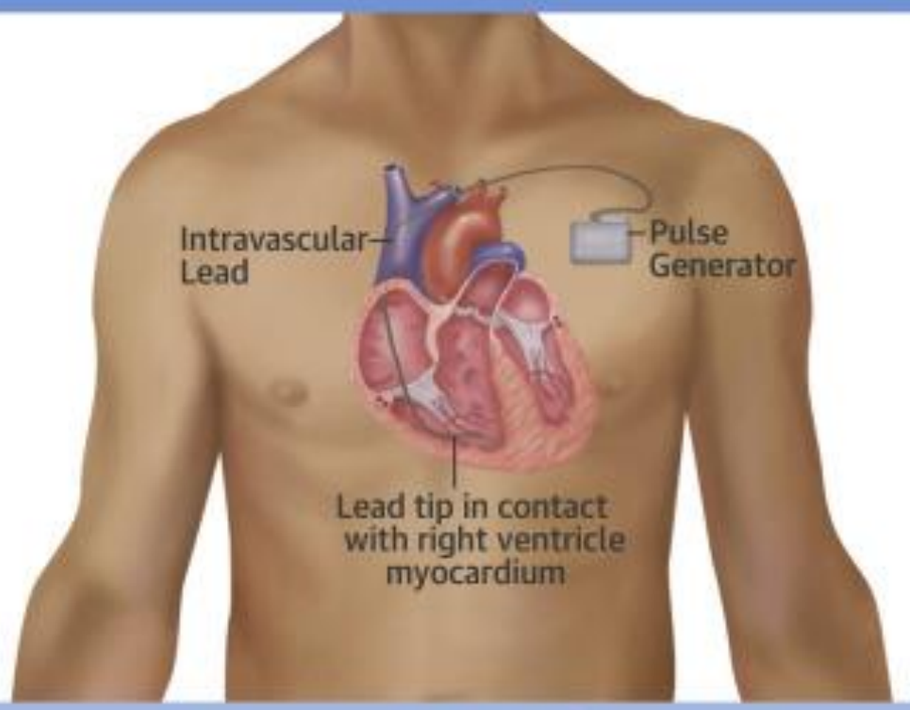
- transveneuze ICD
  - leads endovasculair met risico's van dien
    - perforatie, pneumothorax, dislokatie, infectie, lead fracture
  - brady of resynchronisatie functie
  - mogelijkheid tot ATP

- subcutane (S-) ICD
  - plaatsing onder de huid
  - geen endovasculaire leads
  - geen brady of resynchronisatie functie
  - geen mogelijkheid tot ATP

S-ICD



Transvenous ICD



S-ICD Advantages	Transvenous ICD Advantages
• Eliminate need for vascular access	• Pacemaker and ATP functionality
• Possible to implant without fluoroscopy	• Smaller pulse generator
• Reduced mid-term risk of lead malfunction	• Better battery longevity
• Eliminate certain procedural risks (e.g. pneumothorax, tamponade)	• Shorter charge time-faster shock delivery
• Improved arrhythmia discrimination	• Able to deliver CRT
• Relative ease of extraction	• No pre-implant ECG screening required
• Hardware infections not associated with endocarditis	• Long-term follow-up data available

Lewis, G.F. et al. J Am Coll Cardiol. 2016; 67(4):445-54.

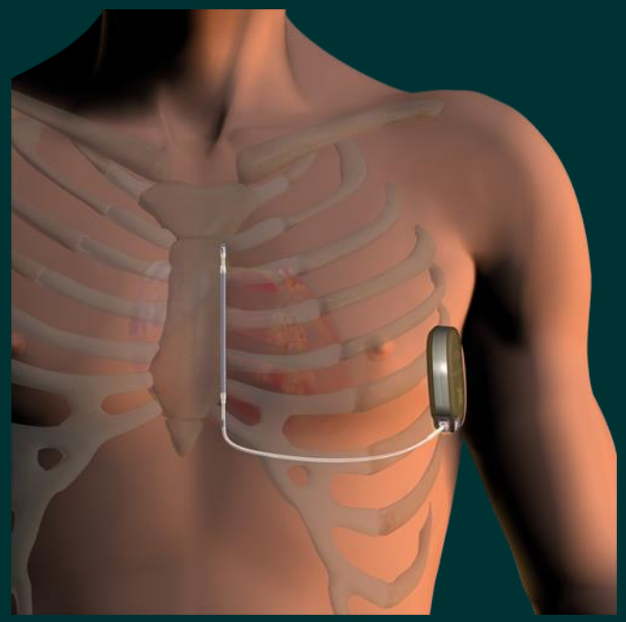
S-ICD patient selectie

- jonge patiënten met lang levensverwachting
  - meerdere wissels (infectie risico)
- actieve patiënten
  - geen dislocatie risico > minder restricties
- weinig co-morbiditeiten (harfalen, bradycardieen)
- niet als recidiverende monomorfe VT (ATP indicatie)

Duurzaam

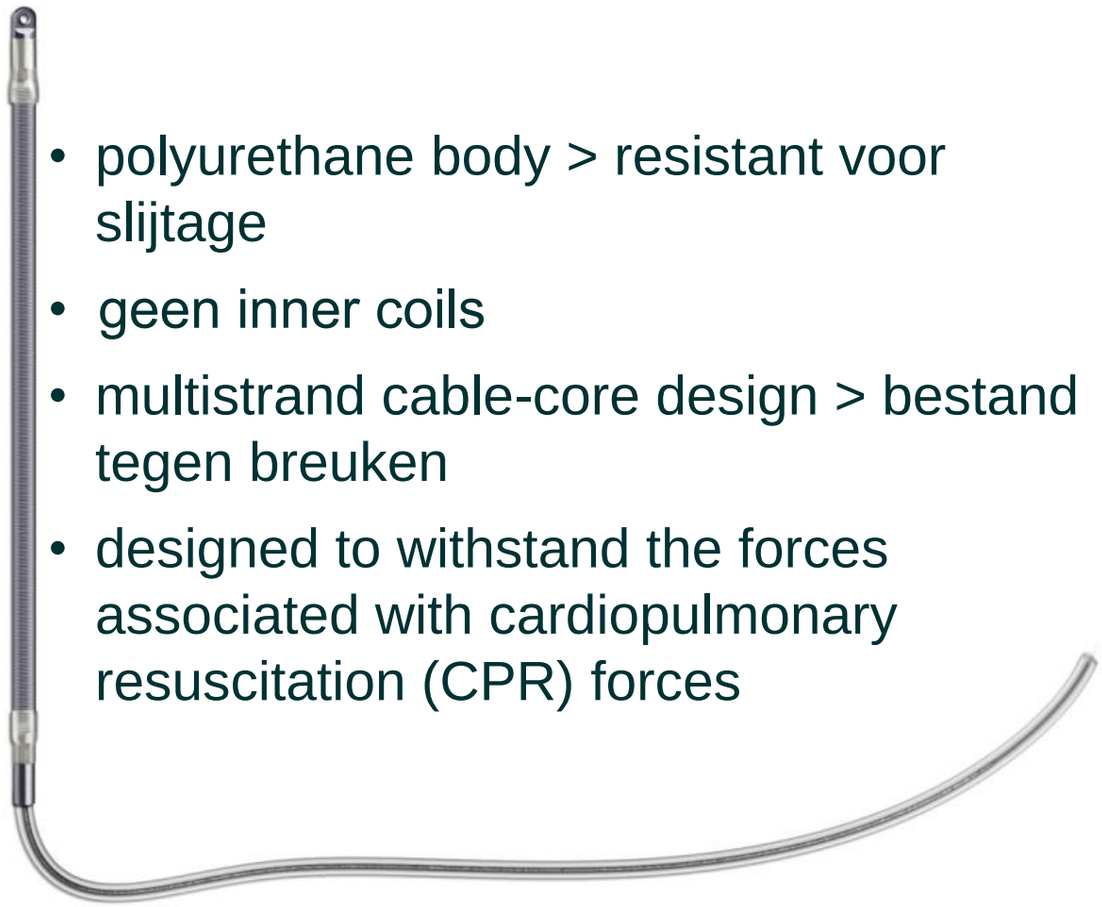
The Subcutaneous Electrode is designed to provide strength and durability

Less Biomechanical Stress



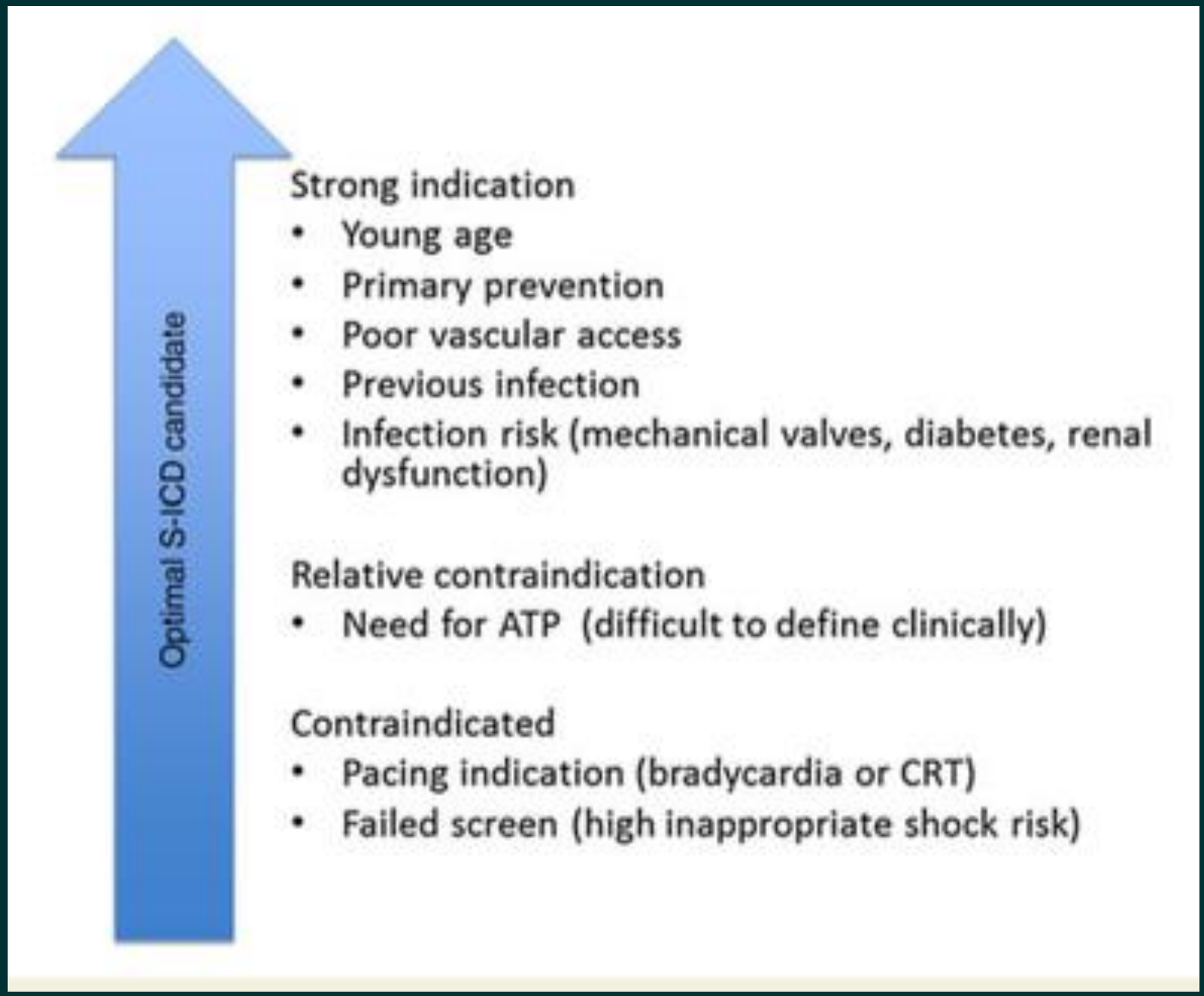
- Not exposed to the dynamics and force of cardiac motion (~100,000 flexes/day)
- Not exposed to clavicular crush forces

Unique Construction

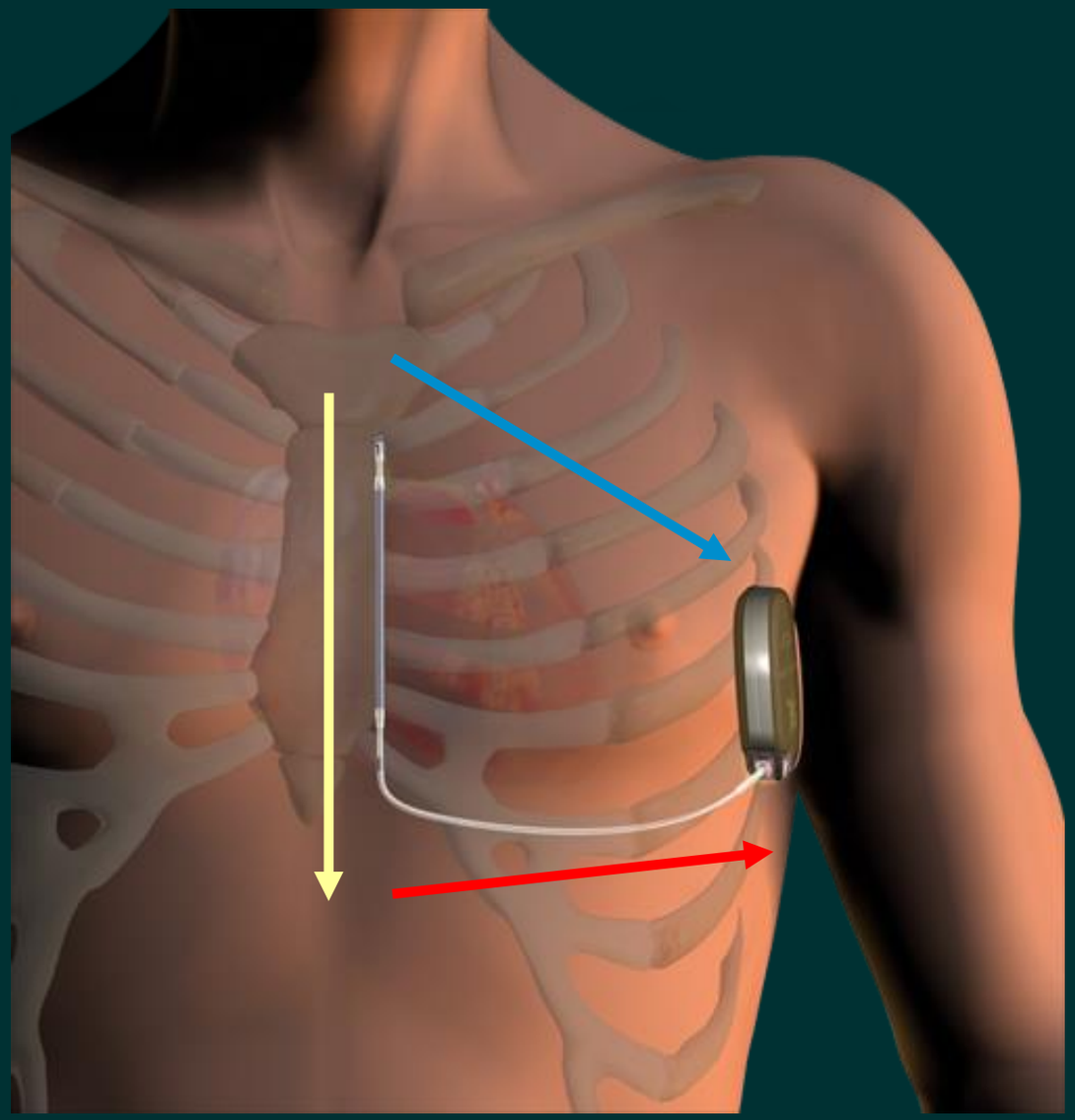


- polyurethane body > resistant voor slijtage
- geen inner coils
- multistrand cable-core design > bestand tegen breuken
- designed to withstand the forces associated with cardiopulmonary resuscitation (CPR) forces

S-ICD patient selectie



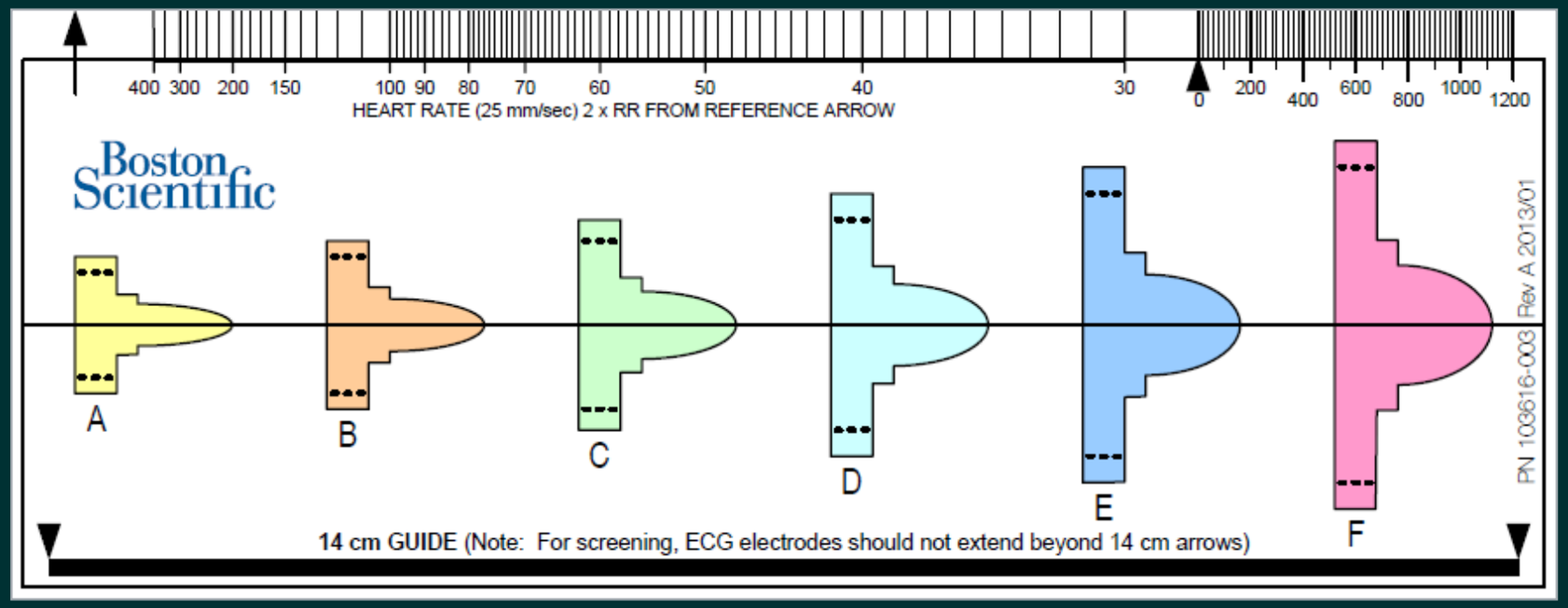
Sensing

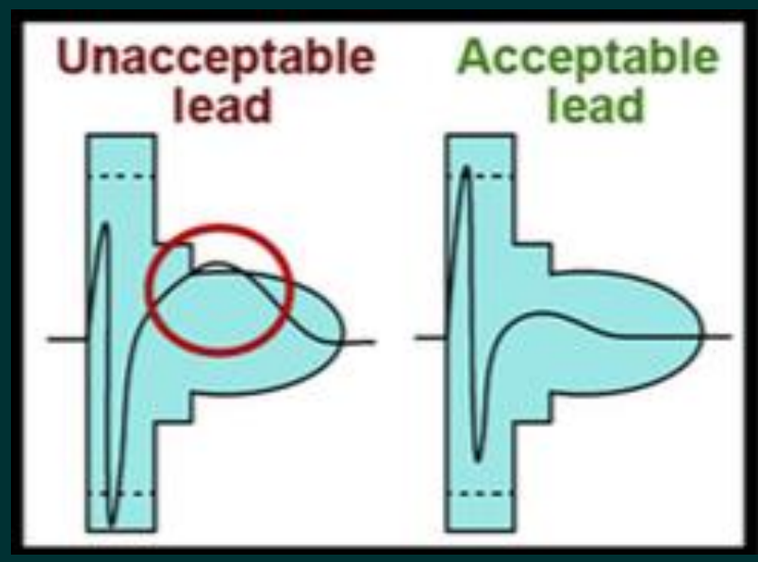


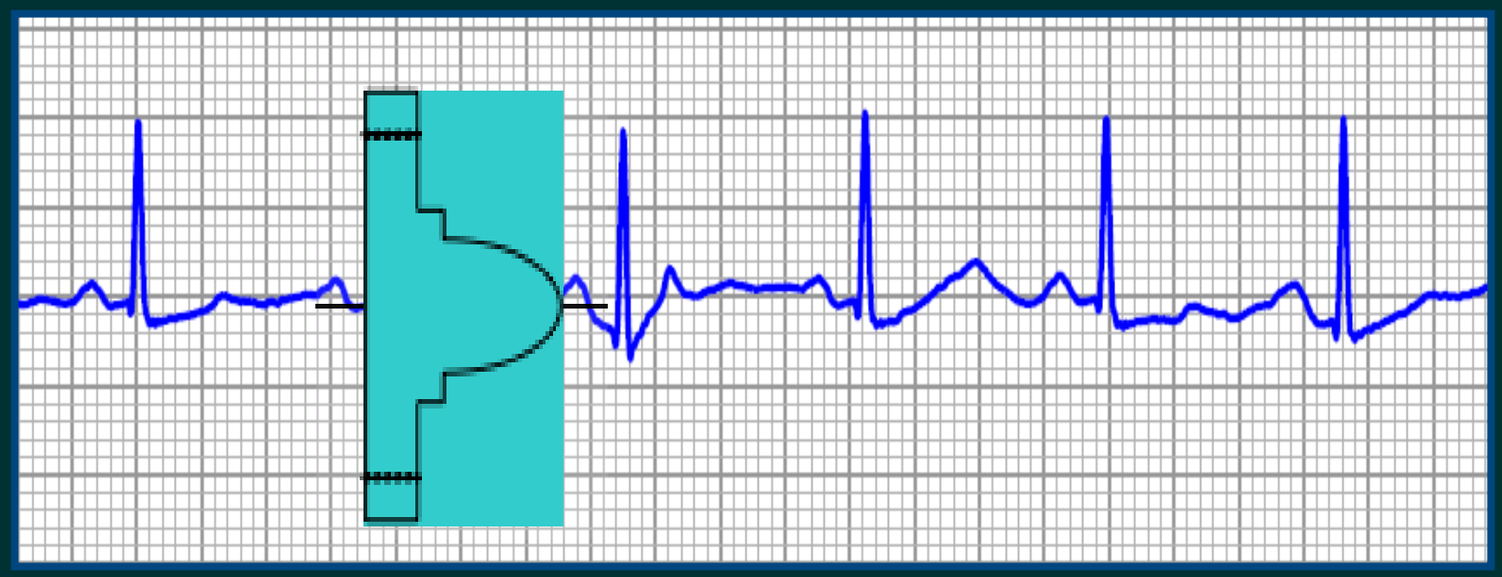
- Three sensing vectors provide different perspectives of patient's cardiac rhythm for optimal sensing

Screening

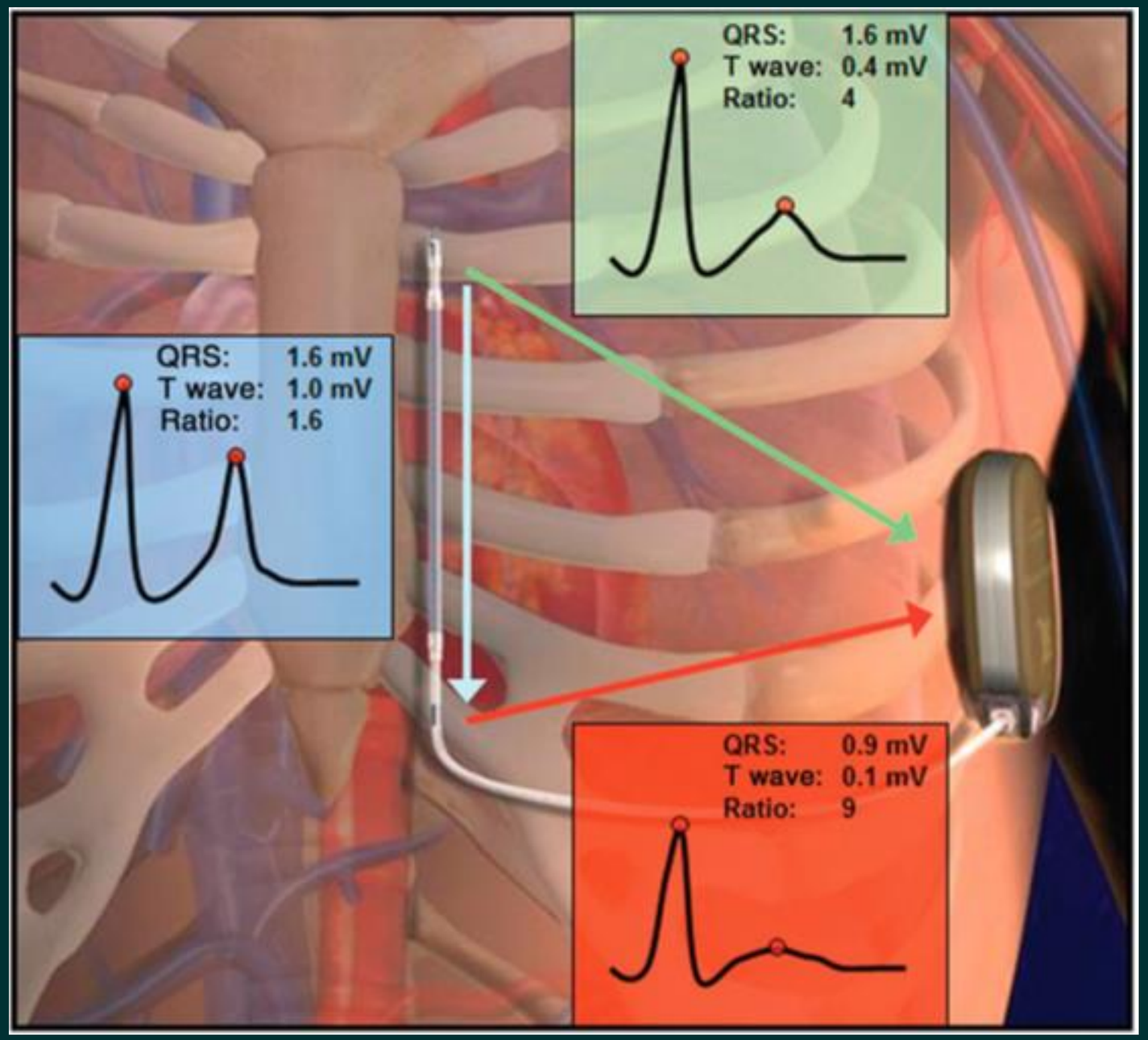
A 3-lead surface ECG is used to assess the appropriateness of surface signals that correlate with device detection



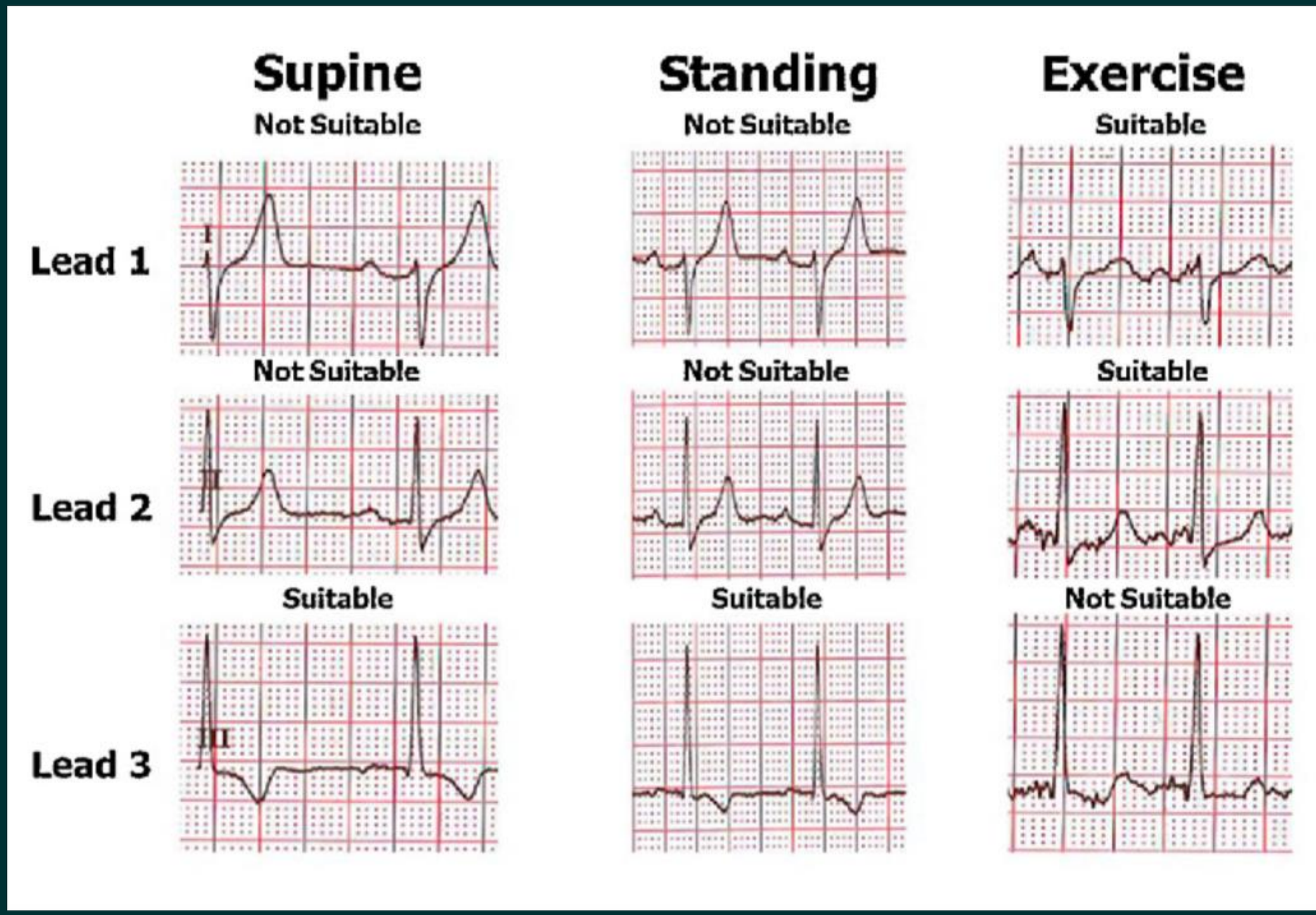




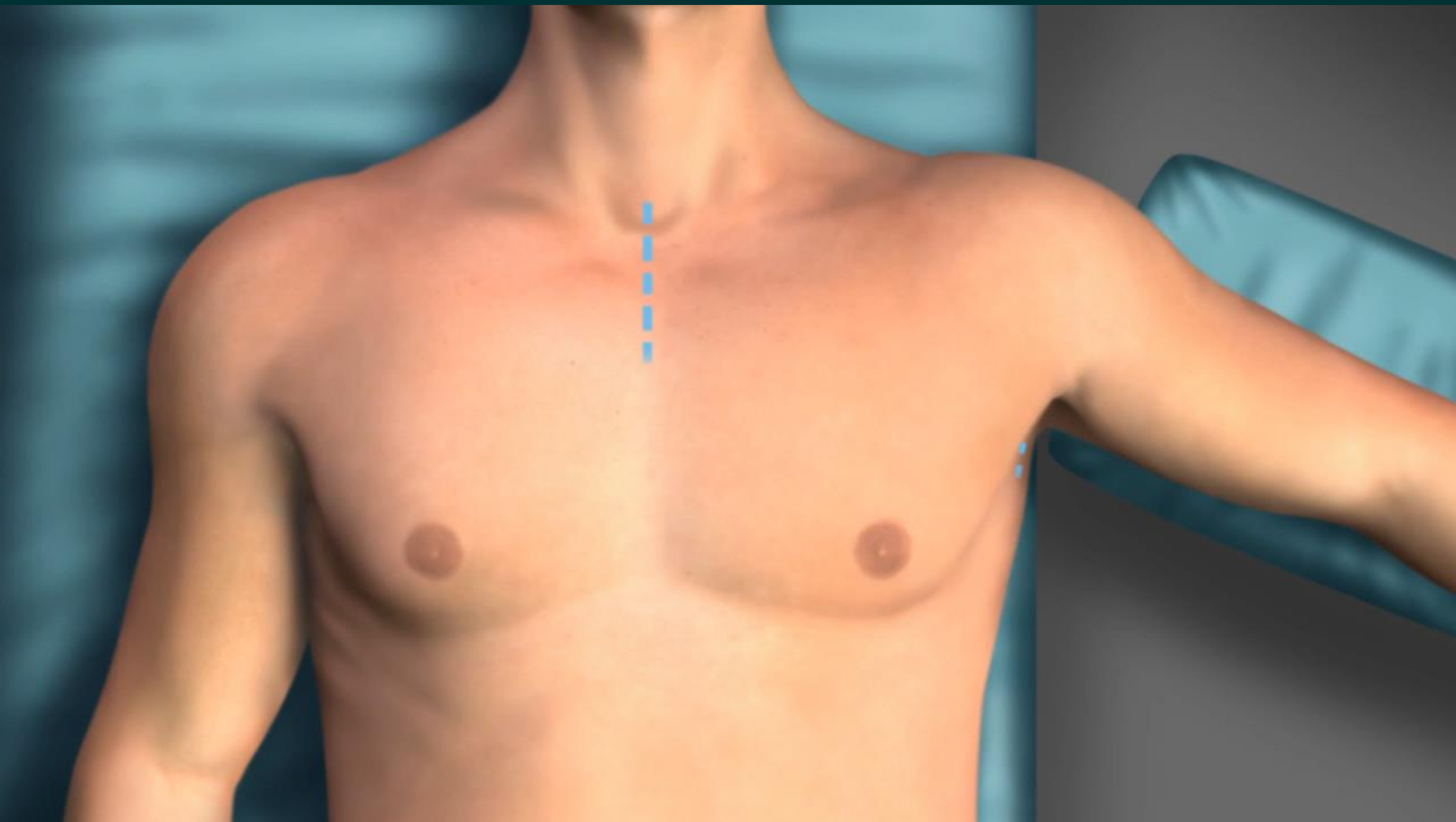
vector bepaling



Houding / exercise



S-ICD

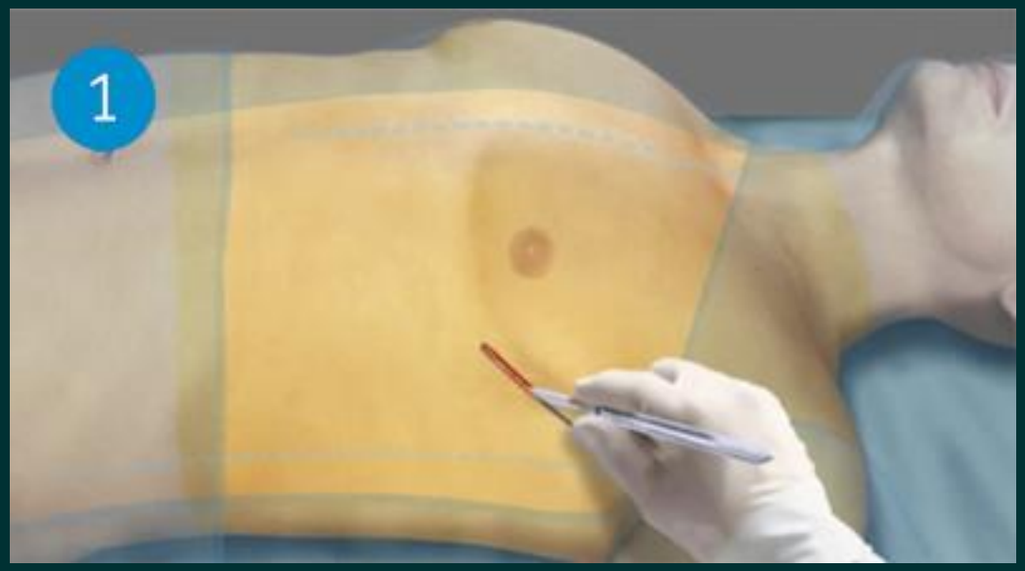


Techniek

- plaatsing S-ICD: incisie 9-10 cm
  - linkerzijde van de borstkast ter hoogte van de 5e intercostaal ruimte

- plaatsing electrode: sternaal, incisie 1-2cm

Stap 1

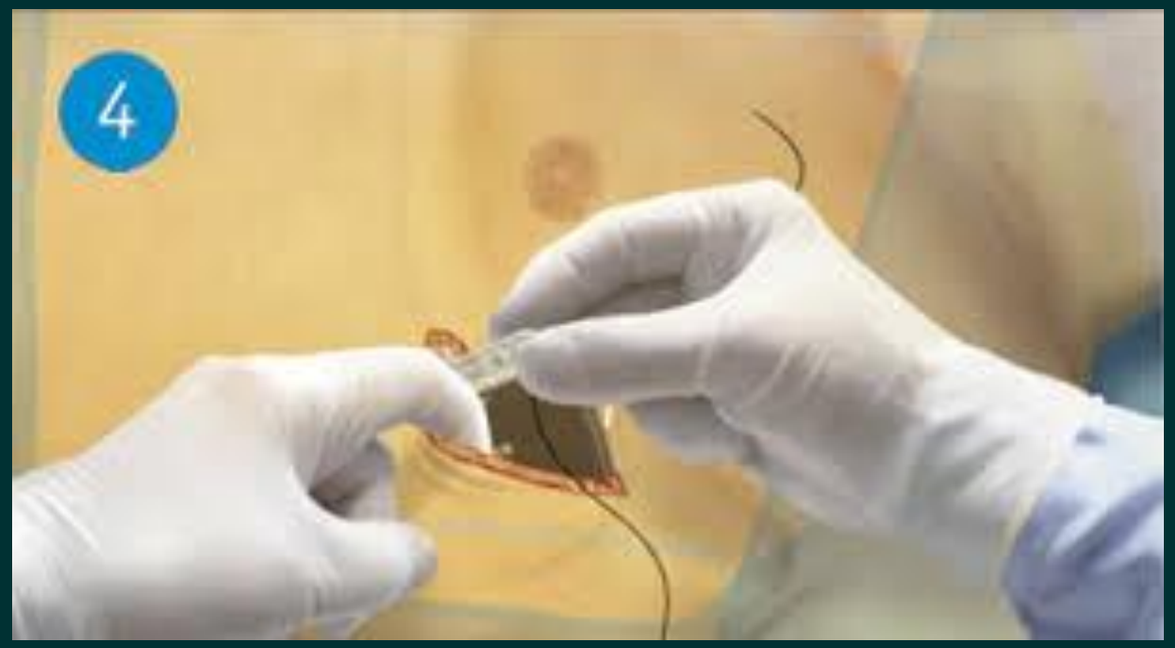


- after the patient has been properly prepped and draped, an incision is made to place the pulse generator at the mid-axillary like between the 5th and 6th intercostal spaces

Stap 2, 3

- The electrode is positioned through two subcutaneous tunnels from the pocket to the xiphoid incision and from the xiploid incision to the superior site

Stap 4

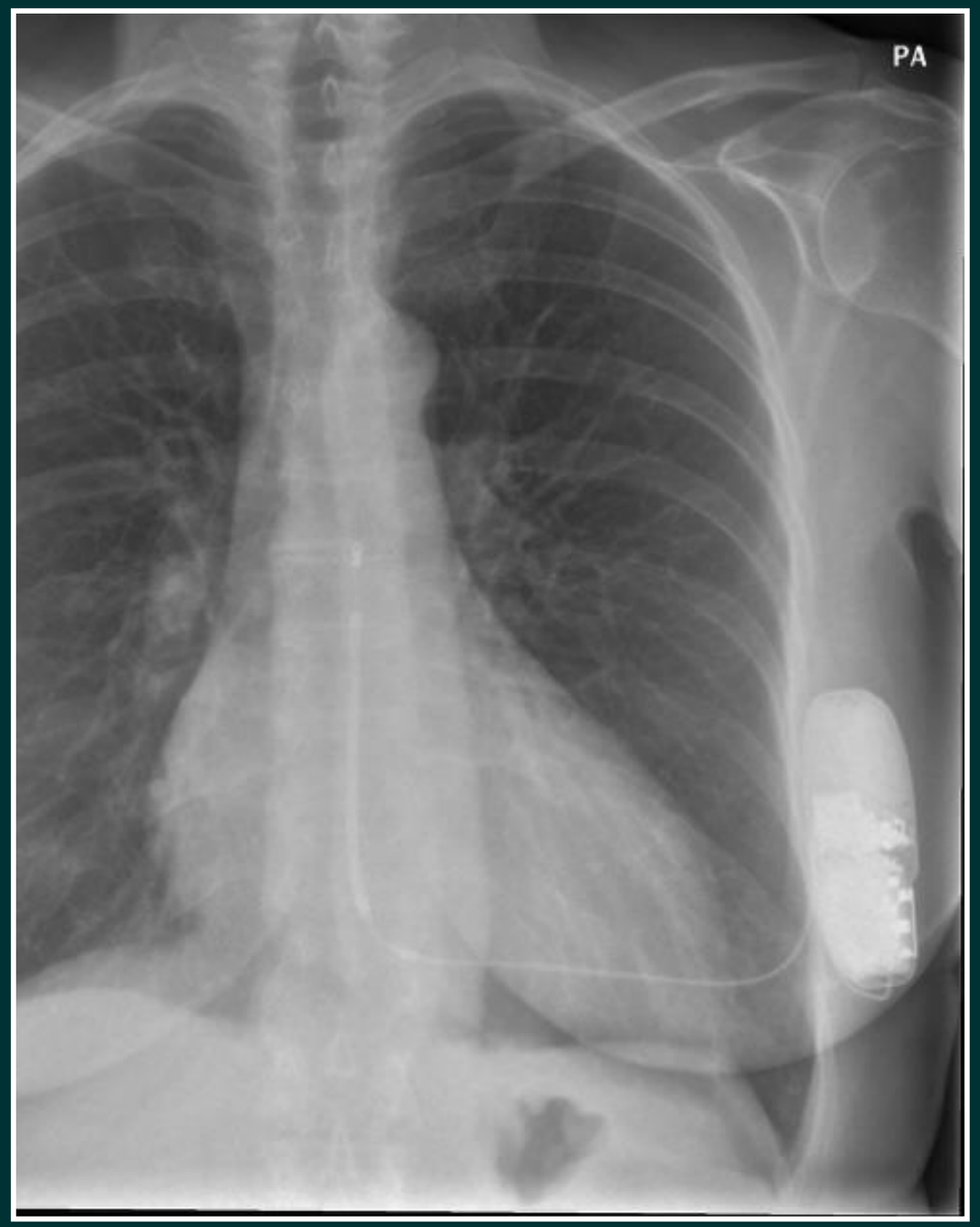


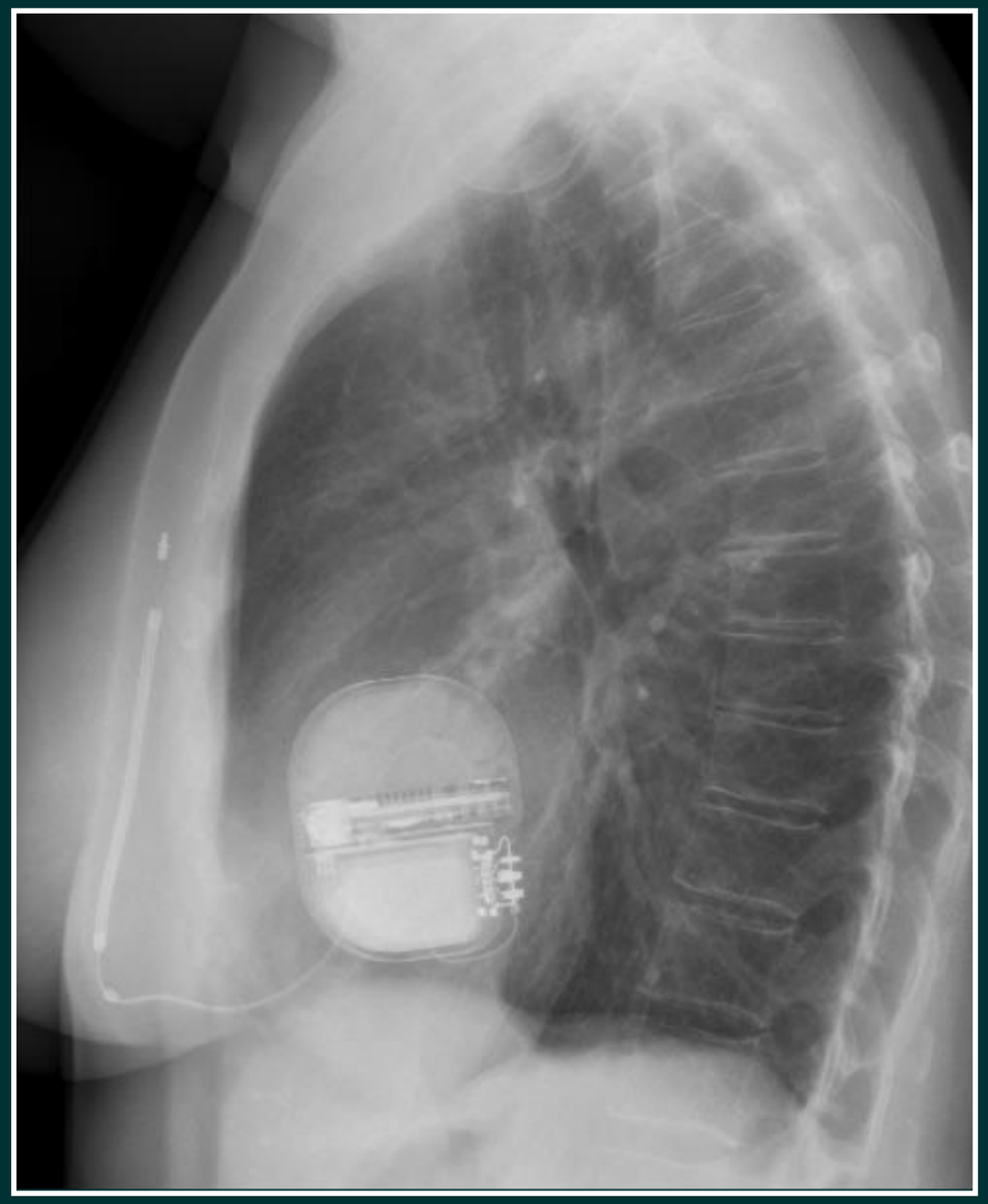
- The pulse generator is connected to subcutaneous electrode and secured in the pocket

Na implantatie

- defibrillation threshold test (DFT)
- programming VT discriminator zone, VF zone
- adviezen: tav wondgenezing (douchen, ontsteking, wijken wond etc.)

Optimale plaatsing

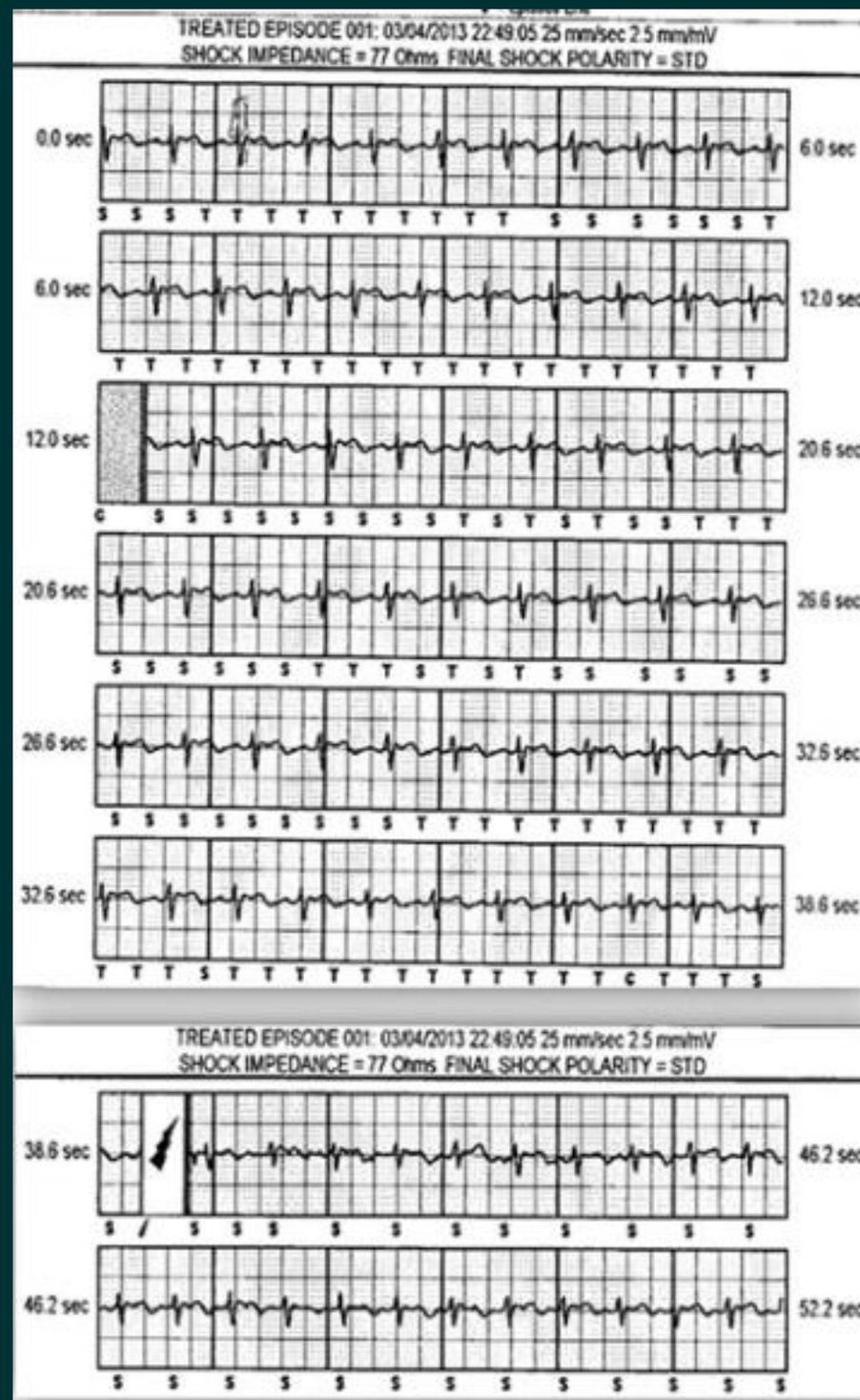




Esthetisch

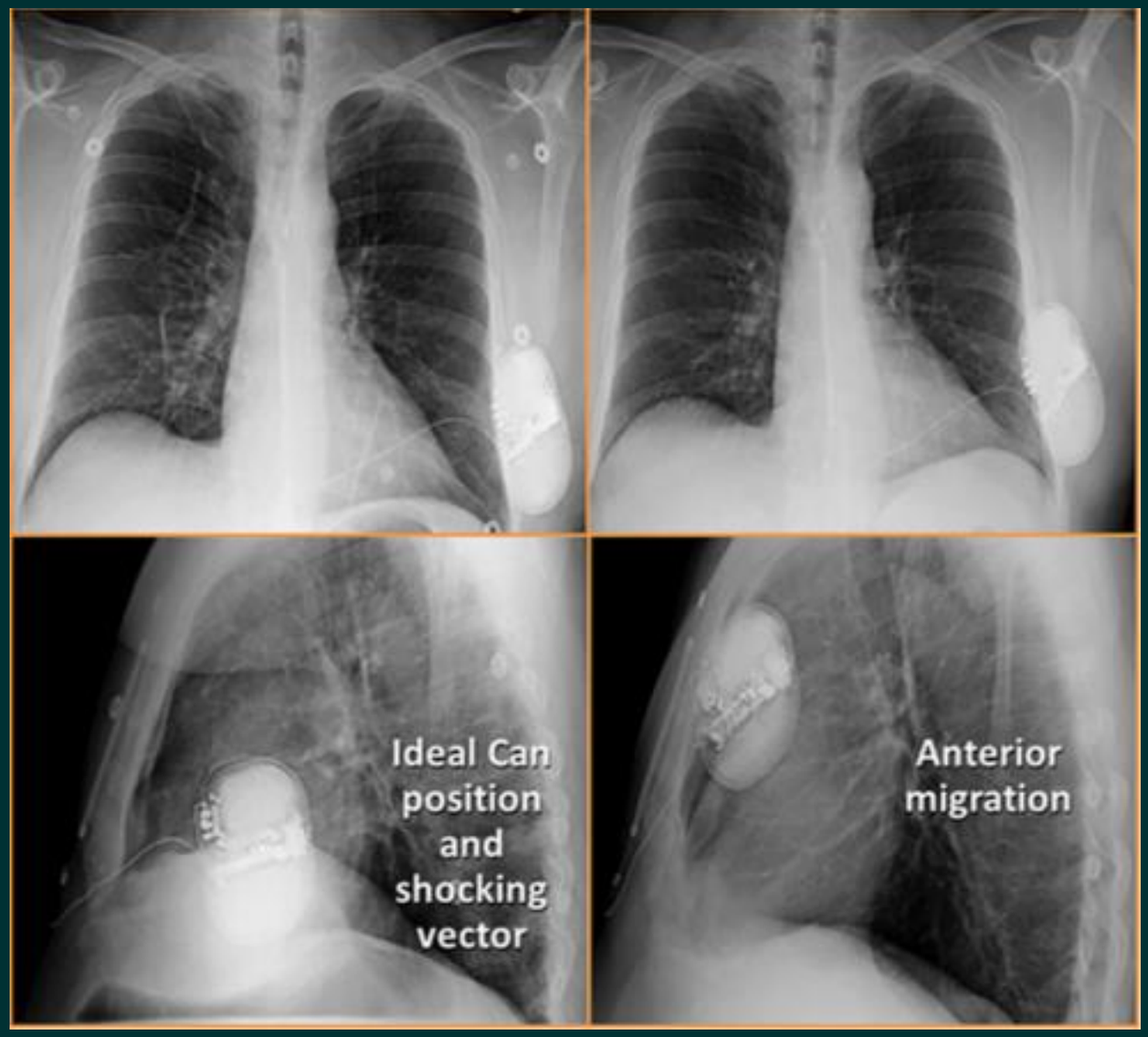
Complicaties

- T-wave oversensing
  - > inappropriate shock
- inappropriate shock rate
- S-ICD 2x > TV-ICD



Complicaties

- Migratie

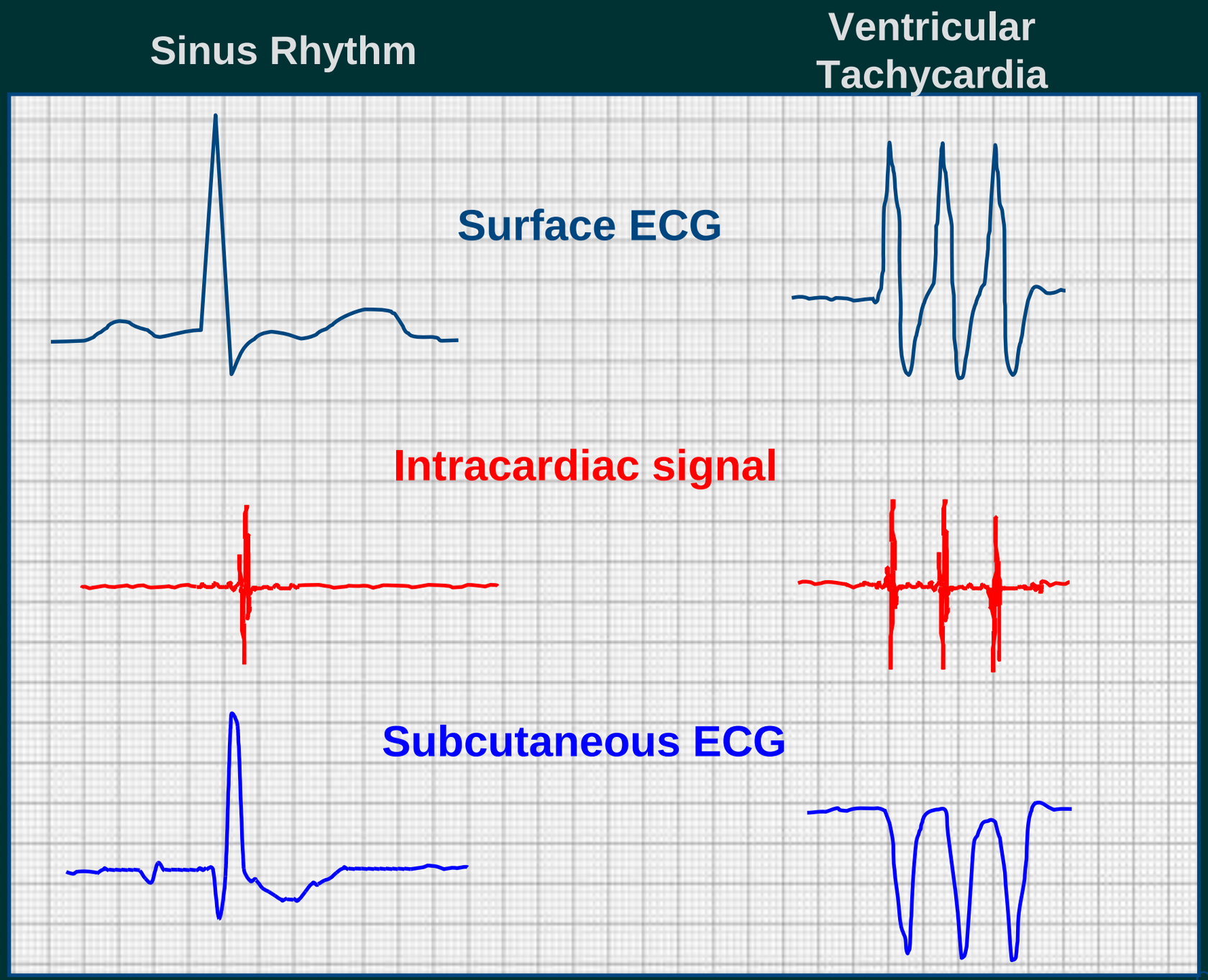


Complicaties

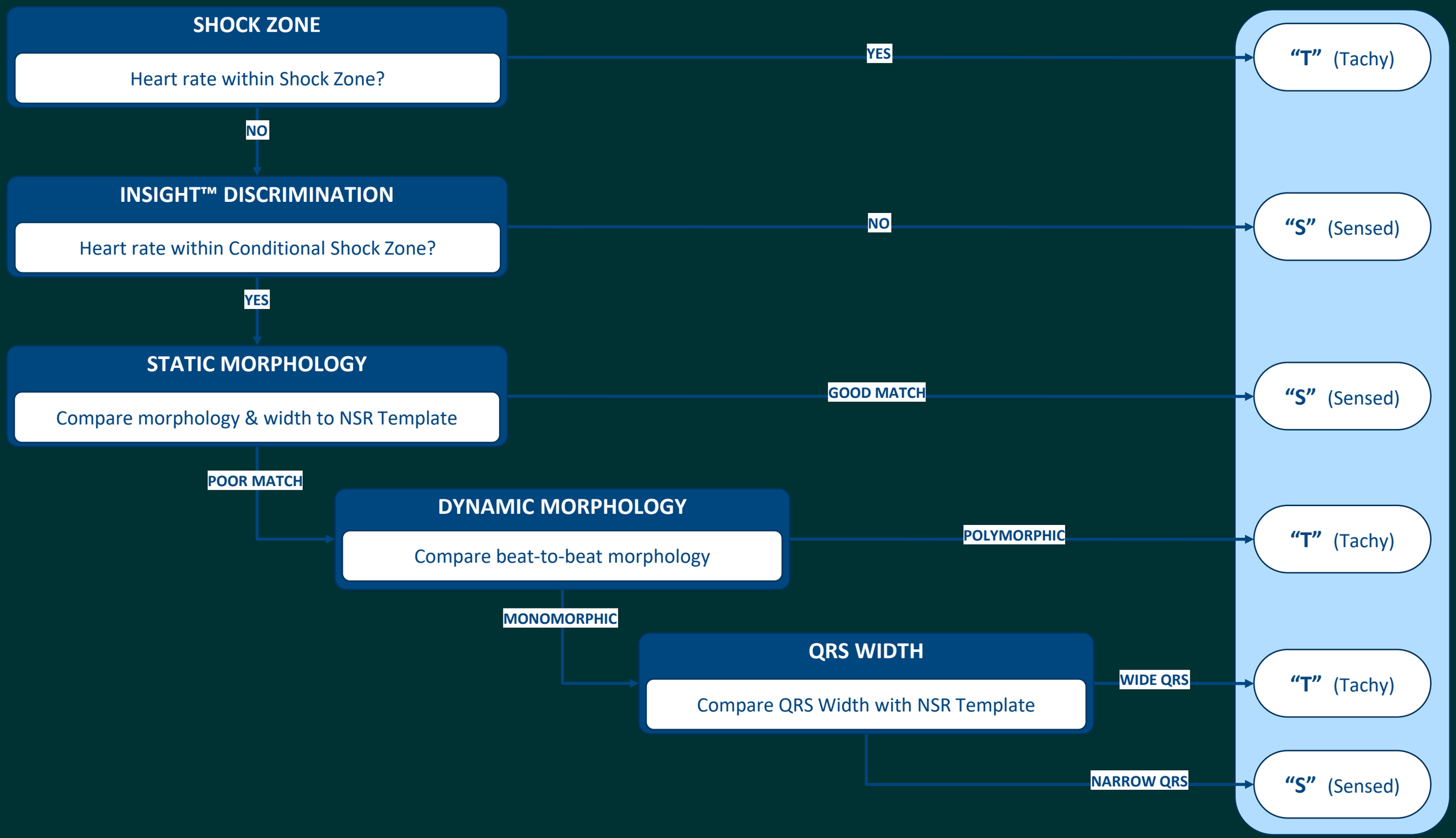
- lead/device malposition /displacement
- haematoma
- Infection (but without bacteraemia)

Far-Field sensing

similar to a surface ECG

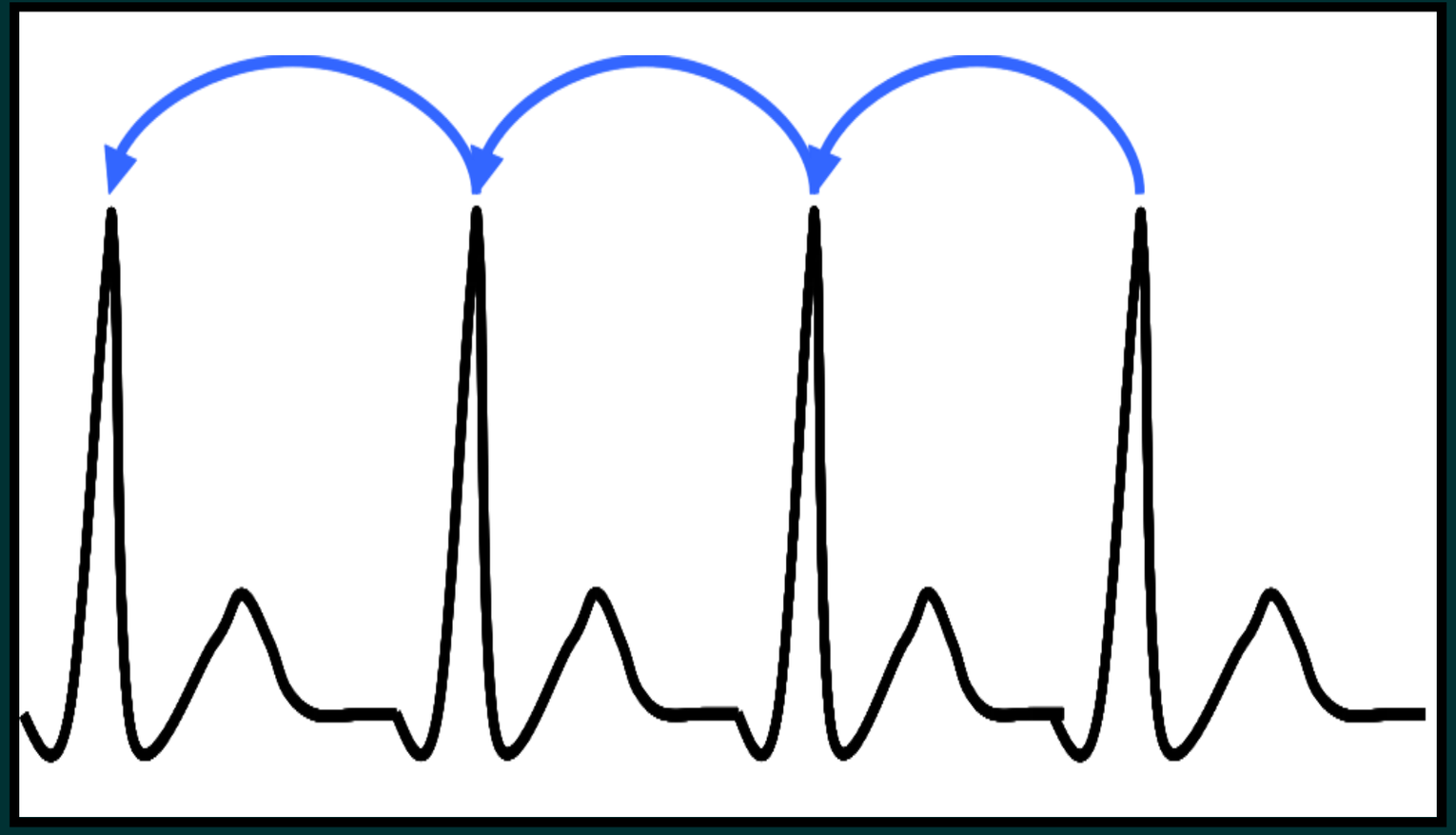


INSIGHT™ Rhythm Discrimination

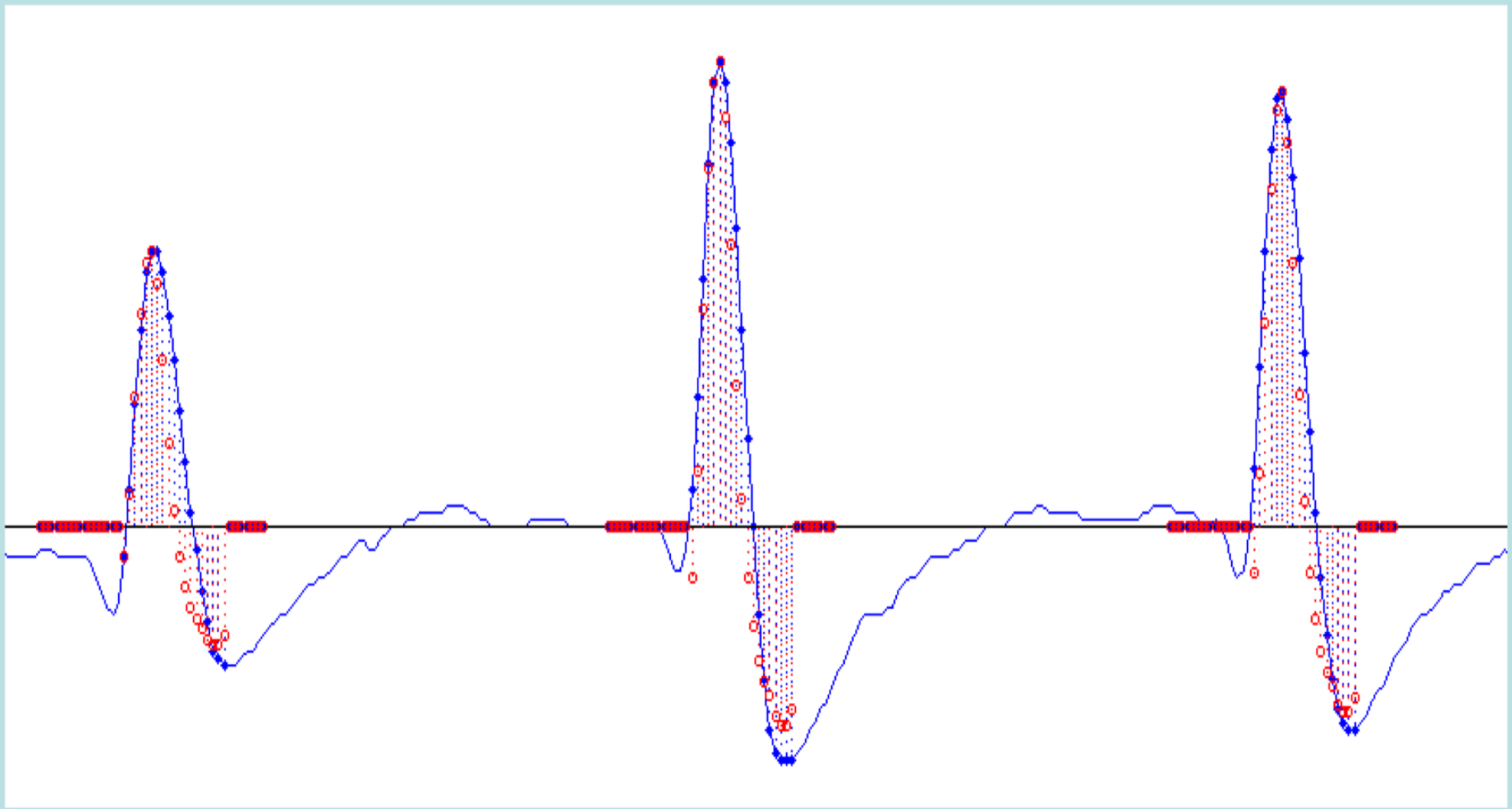


Dynamic morphology Analysis

- Dynamic analysis quickly identifies ***shockable*** polymorphic rhythms
- Consecutive detections are compared to each other, not the NSR Template



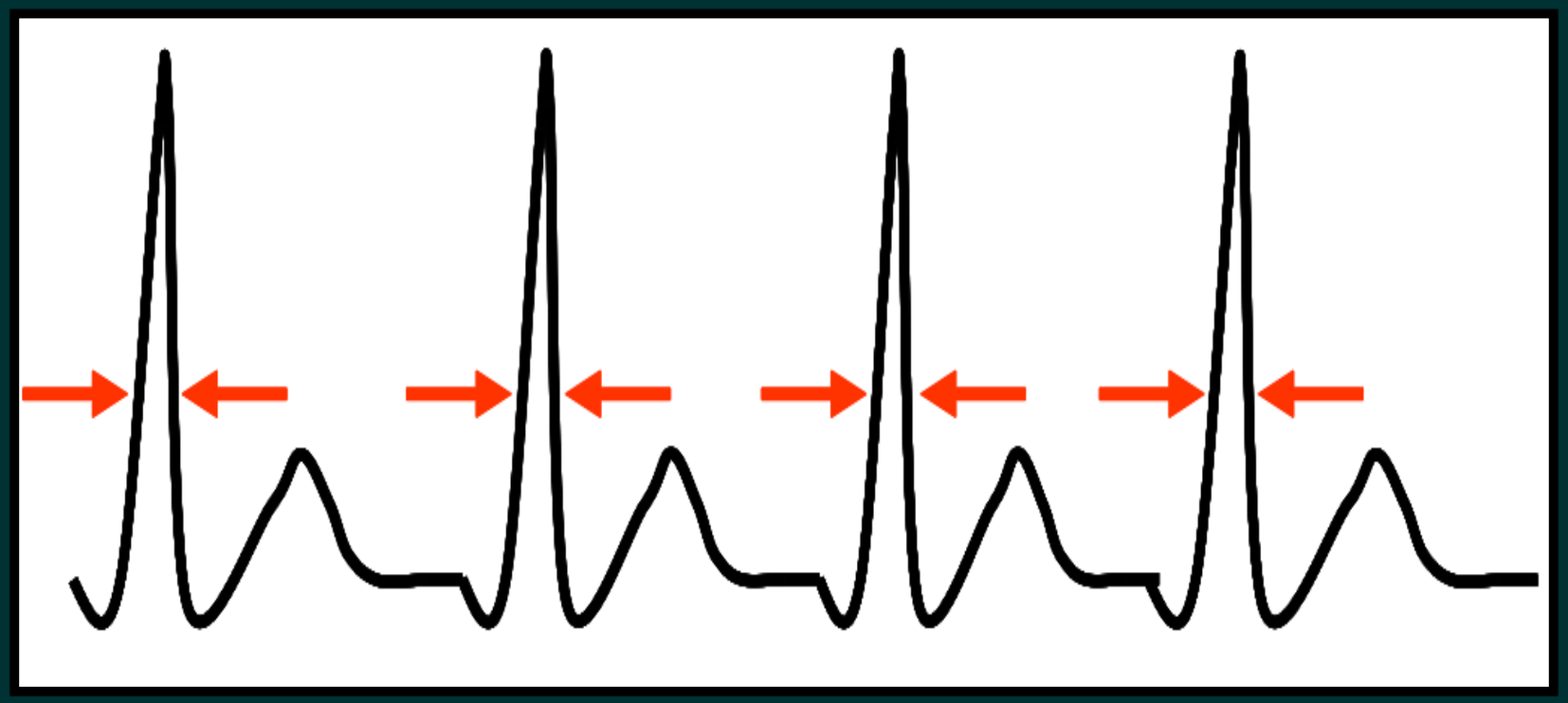
Static Wave Form Morphology



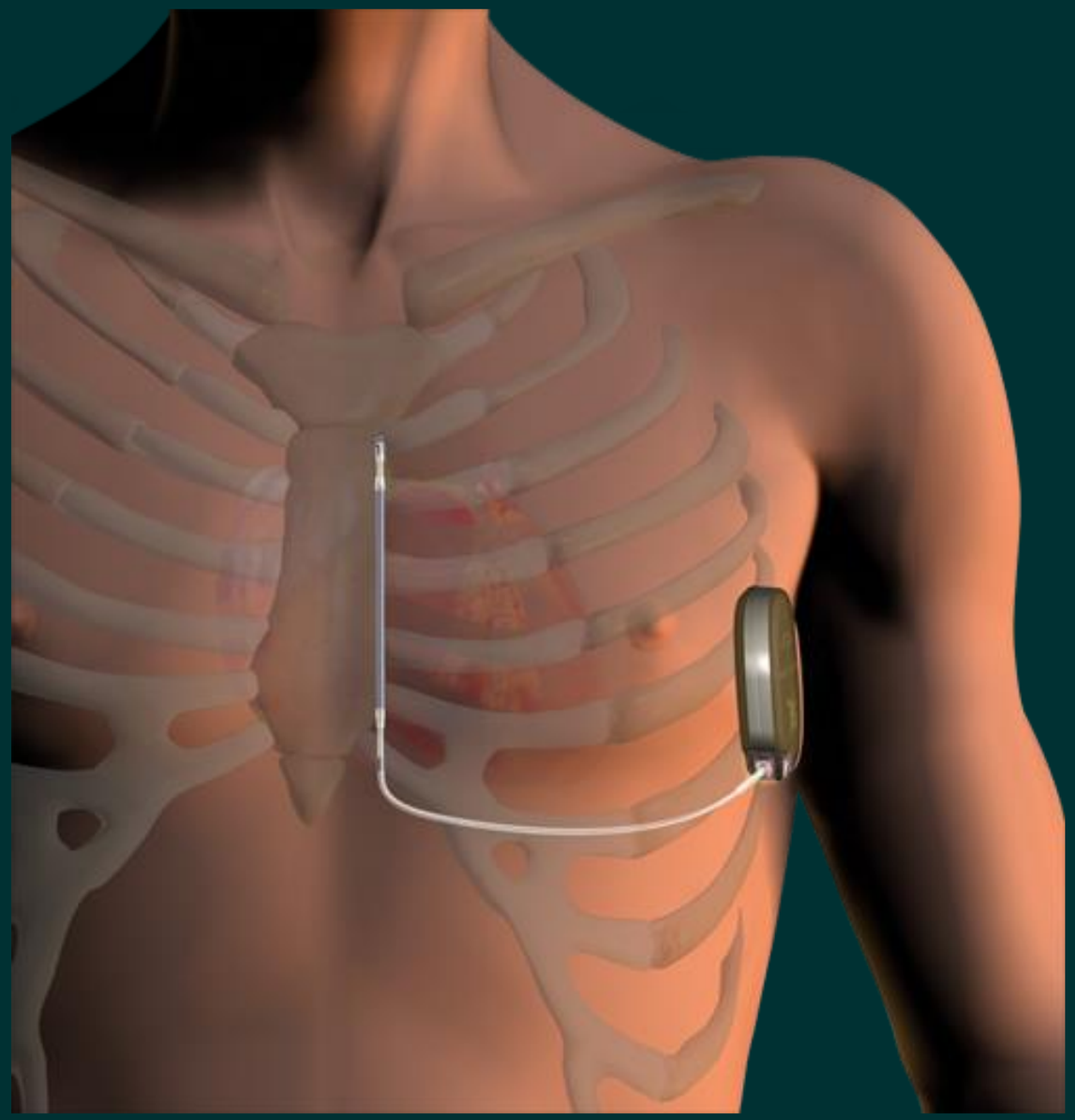
NSR Template (red signal) is aligned and scaled to the current S-ECG signal (blue signal)

QRS Width Analysis

- If Dynamic morphology analysis indicates similar beats, QRS **width** is used to label detections:
  - Normal: QRS Width narrower than the NSR Template
  - VT: QRS Width wider than the NSR Template



S-ICD therapie



- Biphasic shock
- 80J (delivered)
- Up to 5 shocks per episode
- Charge time to 80J ≤ 10 sec
- Post-shock pacing
- Full featured episode storage
- Battery longevity: 5 years

Programming S-ICD

- TV-ICD 100 programmeerbare features i.t.t. S-ICD < 10
- sensing vector
- zones
- pacing after shock on/off
- polarity of next shock and time delay to shock (smart charge) can be manually reset
  - but will automatically adjust during operation

Bewijs?

		Olde Nordkamp, et al. 2012	Jarman, et al. 2013	Weiss, et al. 2013	Kobe, et al. 2013	Lambiase, et al. 2014
		multicenter, retrospective	multicenter, retrospective	multicenter, prospective	muticenter, prospective, matched control	multicenter, prospective/retrospective
n		118	111	321	69	472 (P 241/ R 231)
age		50±14	33 (10-87)	52±16	46±16	49±18
Follow-up		18±7 months	13±7 months	330 (17-715) days	217±138 days	558 (13-1342) days
Induced VF 65J	%	100%	100%	acute 100%; chronic 96%	95.5% (initial polarity 89.5%)	95%
Induced VF 80J	%	-	-	chronic 100%	-	99.7%
Spontaneous VT/VF	%	98.00%	100%	97%	100%	96%
Infection or skin erosion	n	9	11	6	1	18
Lead/Devce Reposition	n	3	1	0	0	6
Inappropriate Shock	%	12.7%	15.3%	13.1%	7.2%	6.8%
Due to TWO	n	9	11	~22	3	~18
Due to SVT	n	1	1	16	0	7
Due to noise	n	1	5	3	2	4
Death	n	2 (cancer and heart failure)	1	8	1 (heart failure) (& 1 misising)	2

inappropriate shocks

- first results: inappropriate shock rates of 20% at 3 years
  - introduction of dual-zone programming cuts the inappropriate shock rate at 3 years to 11.7%

- dual-zone programming as compared to single zone programming: 70% reduction in in-appropriate shocks for SVT

What to do in case of inappropriate shock

- interrogate, chest X-ray

- optimizing the sensing vector
- adding a conditional zone (if not present)
- modifying the detection rate
- storing a baseline template during exercise testing
- (addition of anti- arrhythmic drugs)
- (ablation)

Take-home message

- elegante procedure voor de ‘ongecompliceerde’ jonge patient
- minder complicaties, minder lange termijn risico’s
- CAVEAT inappropriate shocks ihkv T-wave oversensing