

高醫創新醫療

皮膚交感神經活性 **SKNA**

-自律神經在醫療上的應用



KRANNERT INSTITUTE
OF CARDIOLOGY

INDIANA UNIVERSITY
School of Medicine

蔡維中.高醫心臟內科.

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Disclosures

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- WC. Tsai: None

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源起

自律神經系統

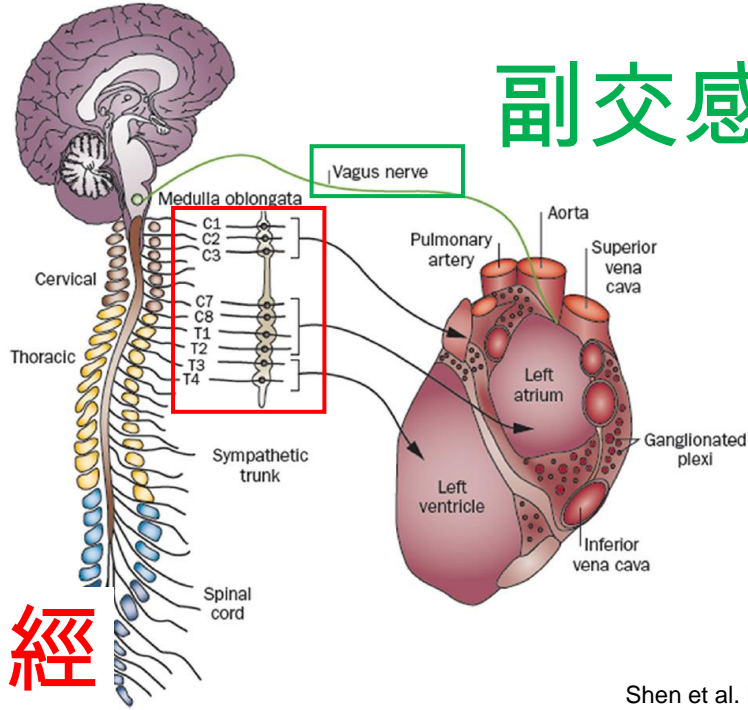
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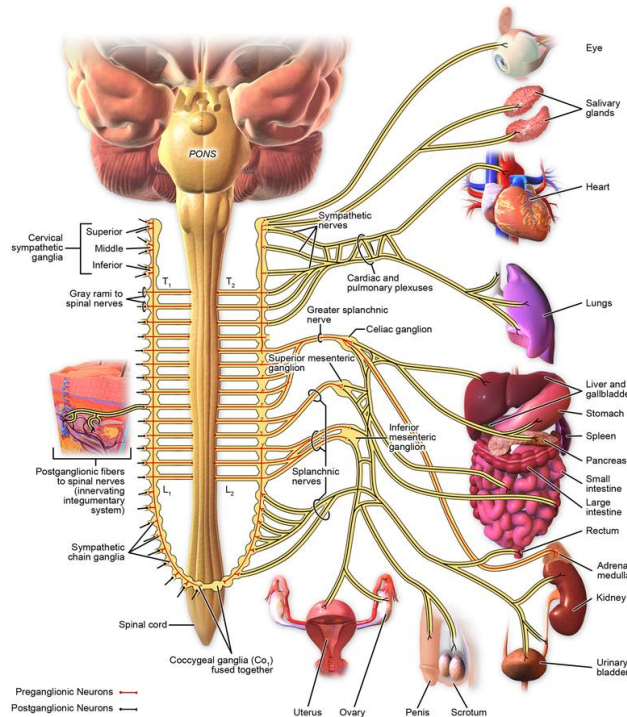
副交感神經

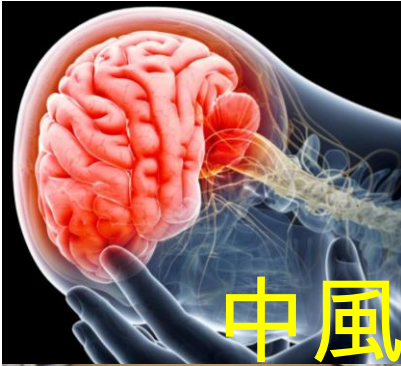


Shen et al. Nat Rev Cardiol 2012

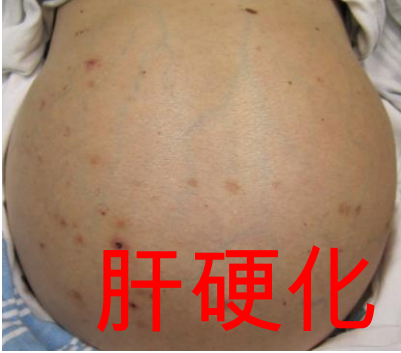
交感神經

交感神經系統

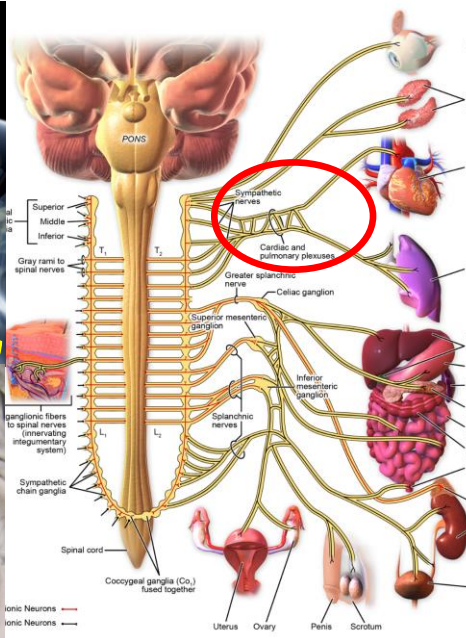




中風



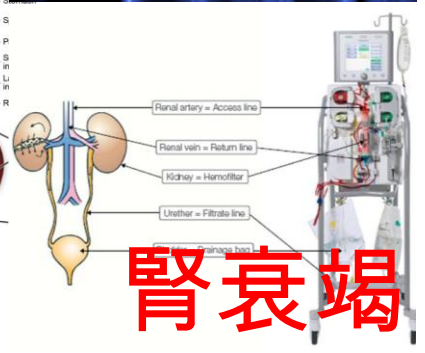
肝硬化



交感神經系統



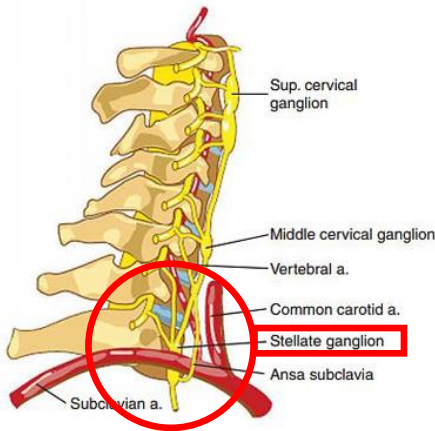
心肌梗塞



腎衰竭

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- 心臟交感神經支配
- 與心律不整相關
- 神經調控
- 疼痛控制
- 創傷後症候群PTSD

星狀神經節

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自律神經系統與心律不整

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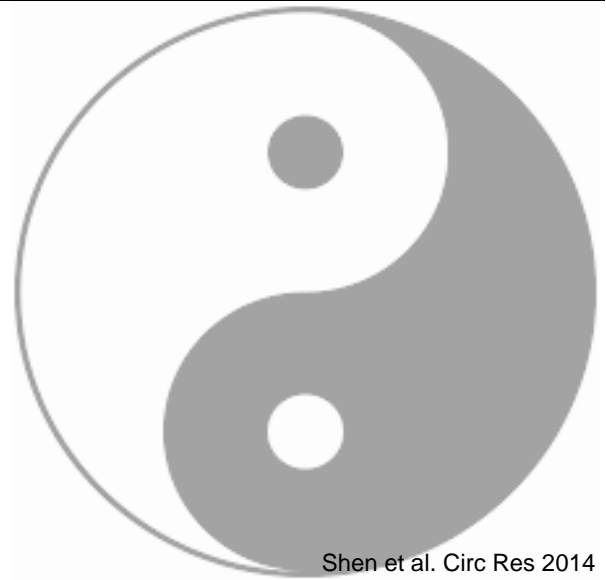
• 交感神經

- 控制心跳速度
- 調控細胞內鈣離子
- 調控心臟電生理

• 心臟生病時 (心衰竭等...)

- 增加心臟再極化的分散性
- 產生心臟後去極化

→ 心律不整！

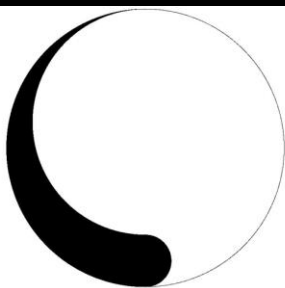


Shen et al. Circ Res 2014

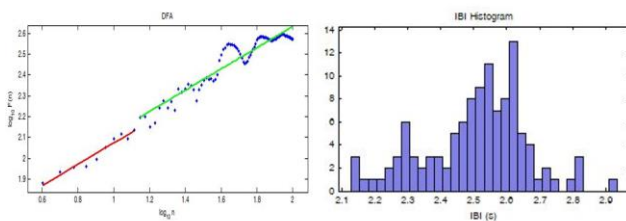
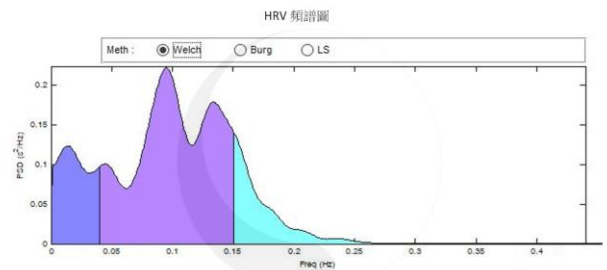
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心律變異HRV

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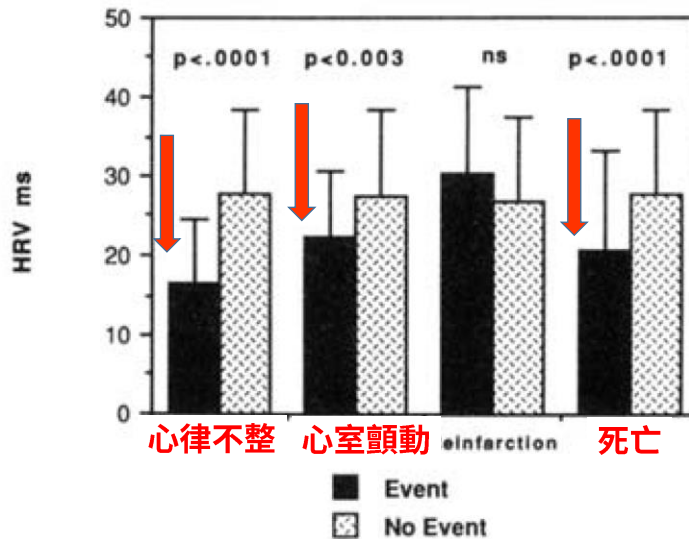
□ 交感
■ 副交感



| 心率變異分析 (HRV) 項目 | 基準期 | 壓力期 | 恢復期 |
|--------------------|-------|-------|-------|
| 平均心跳 (HR, bpm) | 24 | 28.6 | 26.3 |
| 心臟功能指數 (SDNN, ms) | 156.6 | 103.9 | 264.1 |
| 心臟負荷指數 (RMSSD, ms) | 224.1 | 104.9 | 314.7 |
| 常規化低頻功率比 (LF, %) | 81.3 | 76.3 | 58.6 |
| 常規化高頻功率比 (HF, %) | 18.7 | 23.7 | 41.4 |
| 低高頻功率比 (LF/HF) | 4.358 | 3.225 | 1.416 |

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“心律變異HRV” 與心肌梗塞後的風險



Farrell et al. JACC 1991

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2013 ~ 2015



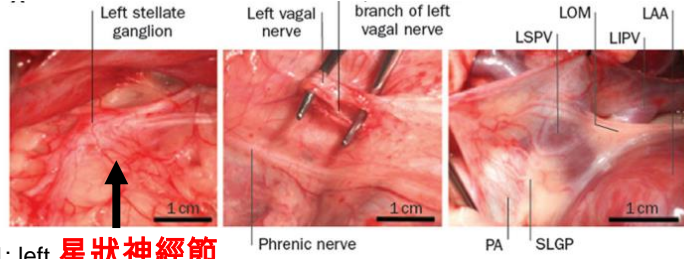
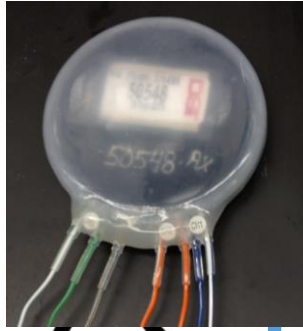
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Renal Sympathetic Denervation (**RDN**) 腎動脈交感神經阻斷術

Skin Sympathetic Nerve Activity (**SKNA**) 皮膚交感神經活性紀錄

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Channel 1: left **星狀神經節**
 Channel 2: left vagal nerve
 Channel 3: ascending aorta

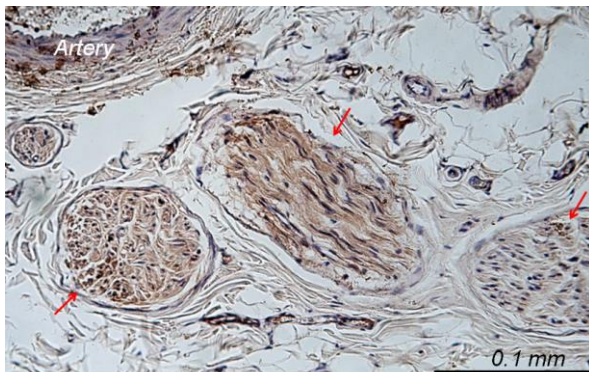
Choi et al, Circulation 2010



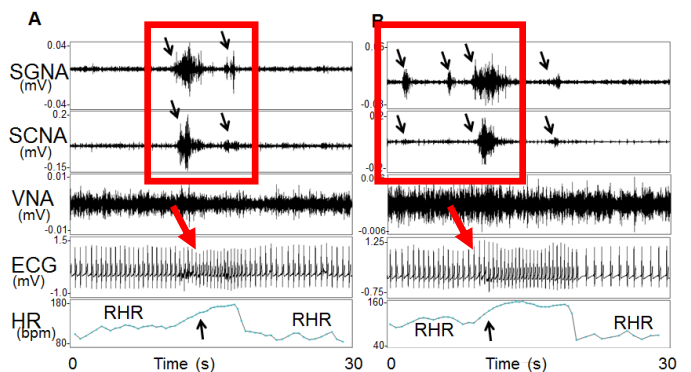
星狀神經節神經活性 (SGNA)

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皮下神經活性 (SCNA)



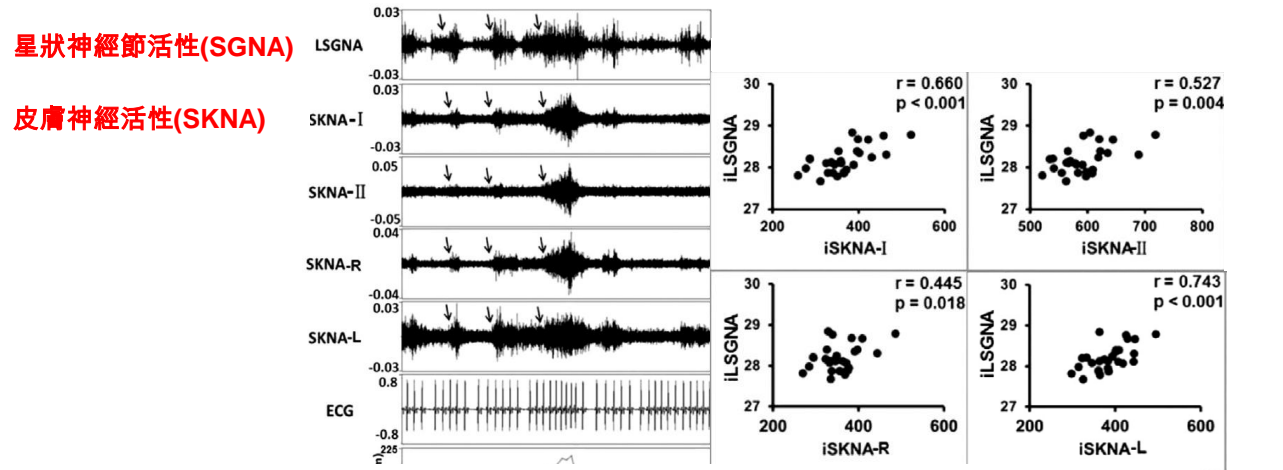
TH, Tyrosine Hydroxylase ;



Robinson et al, JCE 2014

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使用皮膚神經活性 (SKNA) 來預測SGNA



皮膚神經活性SKNA 可以預測 星狀神經節活性SGNA

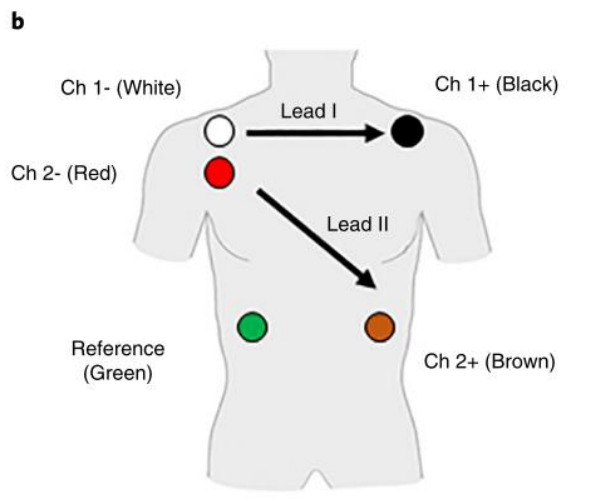
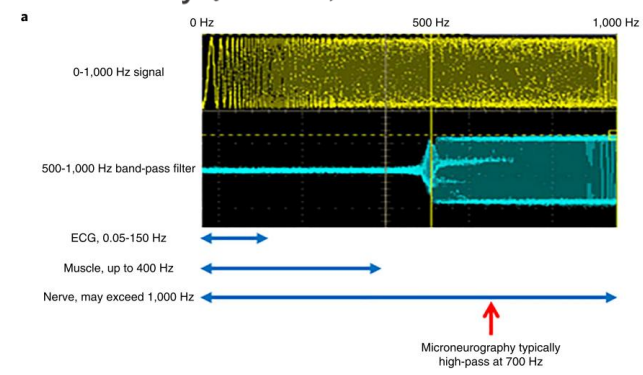
SGNA, stellate ganglion nerve activity; SKNA, skin sympathetic nerve activity; Jiang. Heart Rhythm 2015

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皮膚神經活性 (SKNA)

nature protocols **PROTOCOL**
<https://doi.org/10.1038/s41596-020-0316-6>
 Check for updates

Simultaneous noninvasive recording of electrocardiogram and skin sympathetic nerve activity (neuECG)



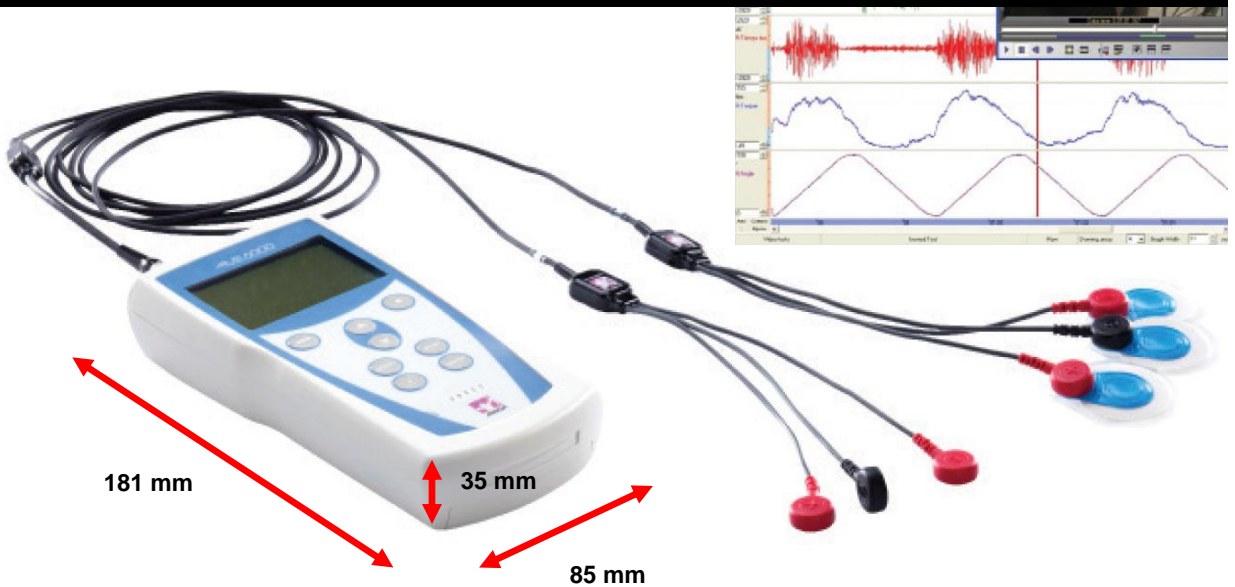
Kusayama et al, Nature Protocols, 2020

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目前應用

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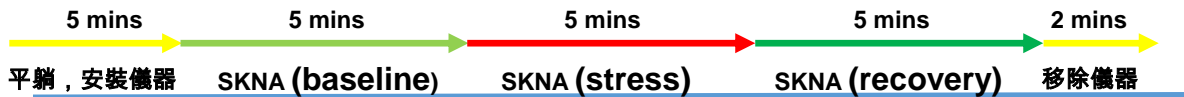
皮膚交感神經活性SKNA記錄



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SKNA 記錄方式

- 0-5 : 請病人躺著休息，安裝生理回饋儀
- 5-10 : **Baseline**基準期，記錄5分鐘
- 10-15 : **Stress**壓力期，**壓力測試**記錄5分鐘
- 15-20 : **Recover**恢復期，記錄5分鐘
- 20-22 : 停止記錄，生理回饋儀關機並且移除導極



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壓力測試

- 心算壓力測試
- 增加交感神經活性！



Kop. Circulation 2004

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臨床發表

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• 心肌梗塞病患之SKNA簇群

Tsai et al, Frontiers in neuroscience, 2021

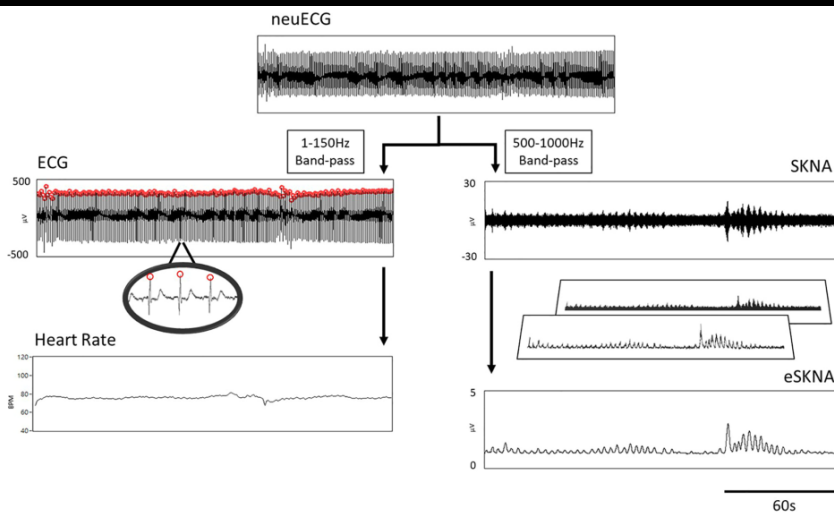
• 昏厥患者之高SKNA值

Tsai et al, Journal of Personalized Medicine, 2021

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心肌梗塞的SKNA應用

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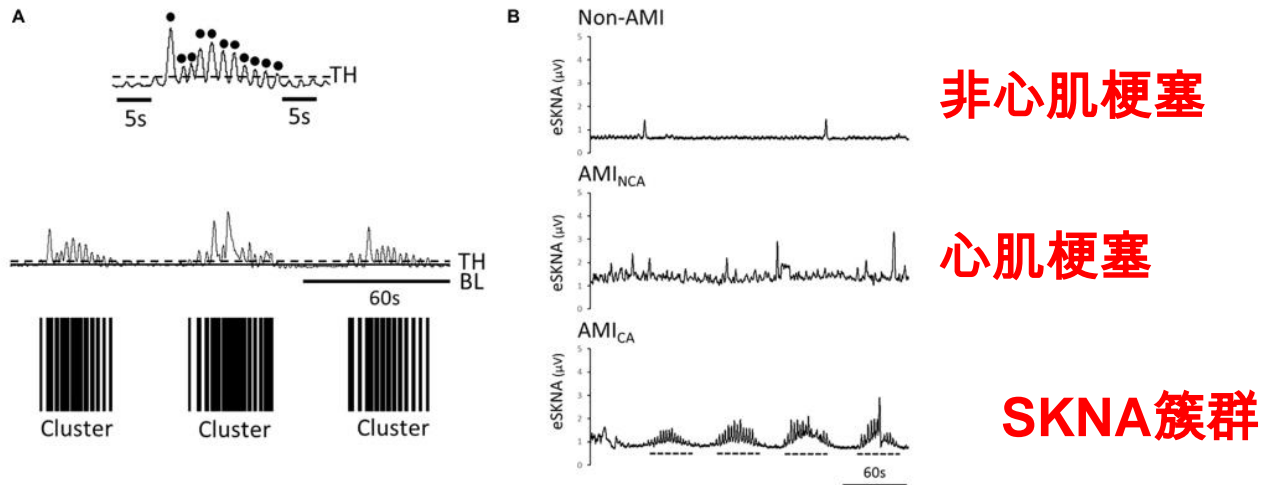


Tsai et al, Frontiers in neuroscience, 2021

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心肌梗塞病患有 SKNA 簇群

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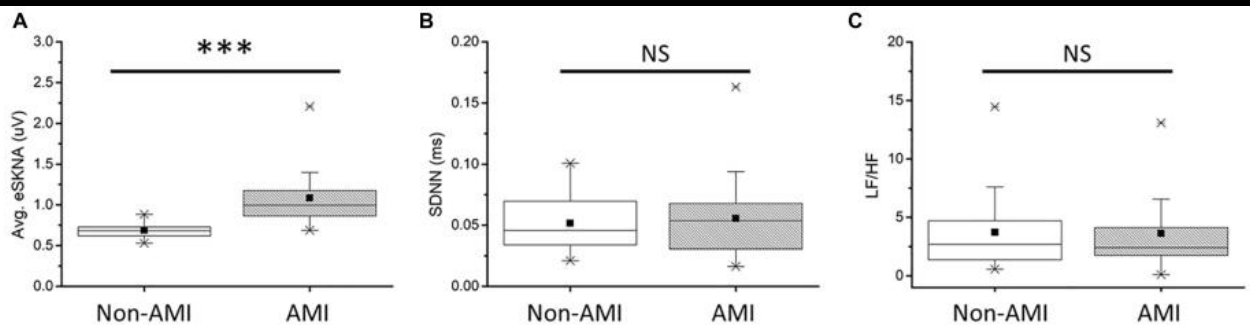


Tsai et al, Frontiers in neuroscience, 2021

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心肌梗塞病患有較高的SKNA

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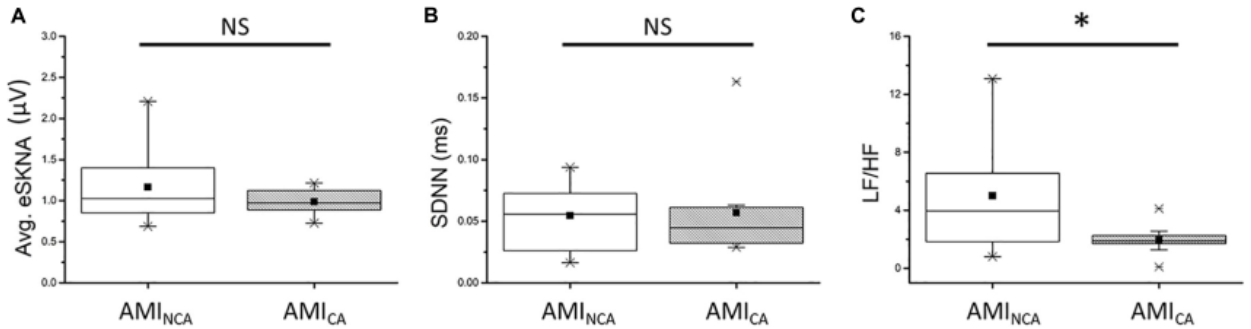
皮膚神經活性SKNA 在 心肌梗塞病患較高!!

Tsai et al, Frontiers in neuroscience, 2021

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SKNA簇群與自律神經平衡有關

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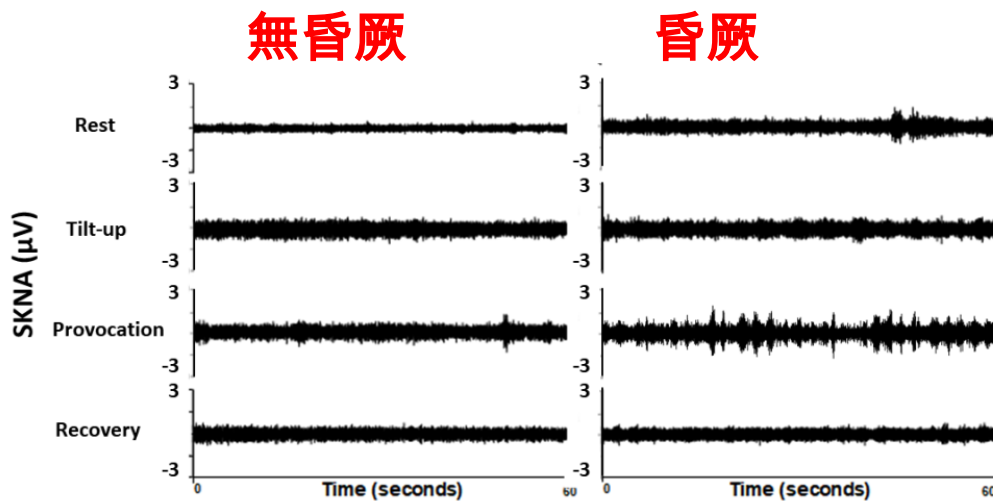
皮膚神經活性SKNA簇群者有較佳的心律變異自律神經平衡!!

Tsai et al, Frontiers in neuroscience, 2021

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昏厥

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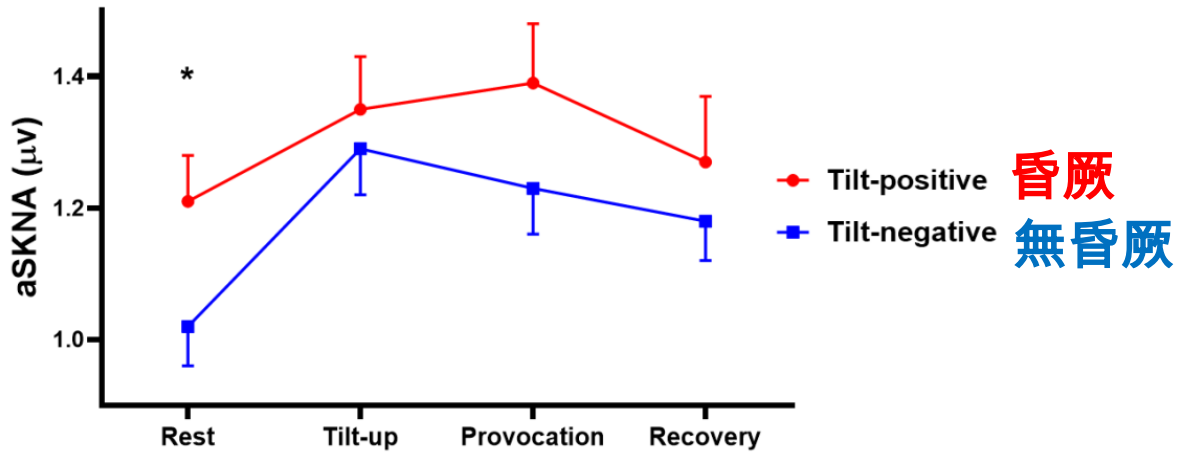


Tsai et al, Journal of Personalized Medicine, 2021

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昏厥者的基礎SKNA值較高

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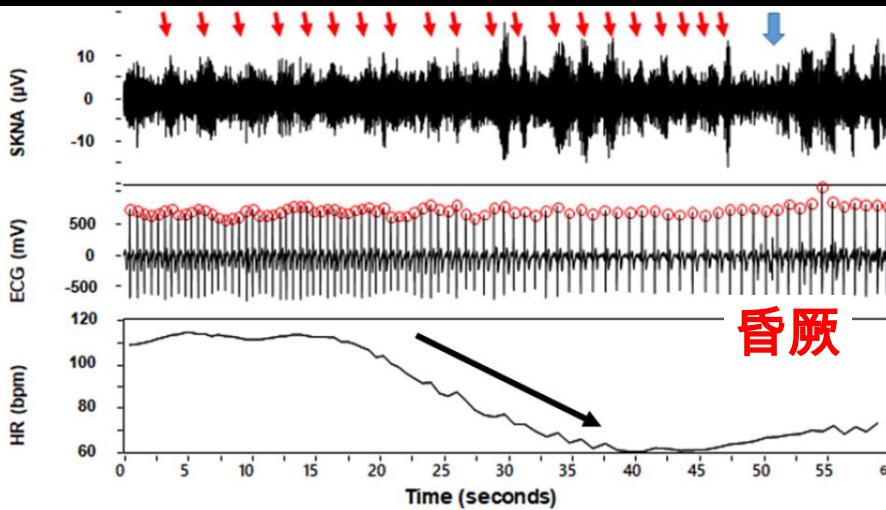


Tsai et al, Journal of Personalized Medicine, 2021

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昏厥前的SKNA活性

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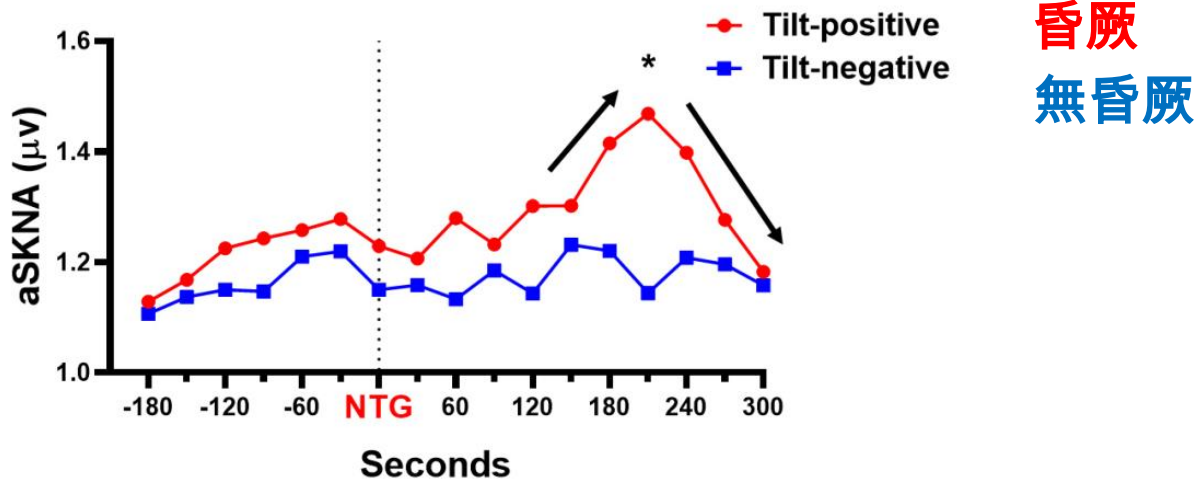


Tsai et al, Journal of Personalized Medicine, 2021

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舌下含錠對SKNA的影響

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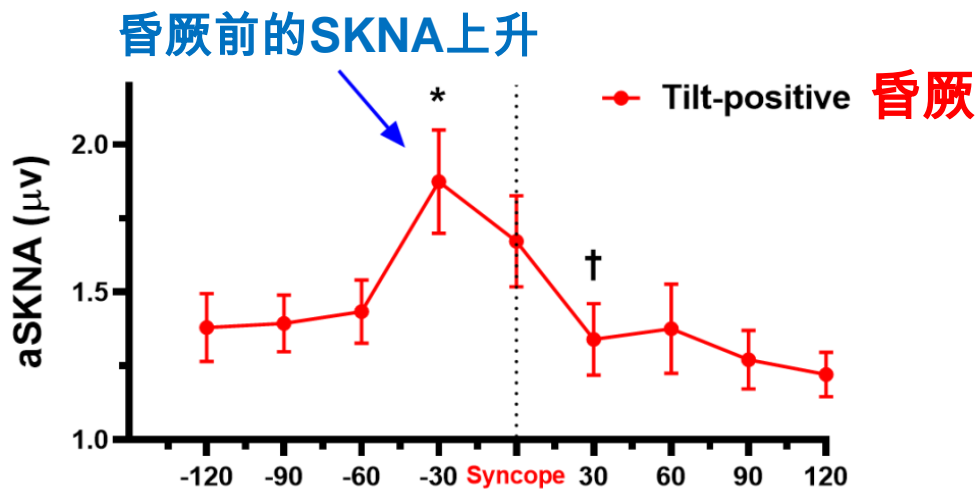


Tsai et al, Journal of Personalized Medicine, 2021

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昏厥前後的SKNA

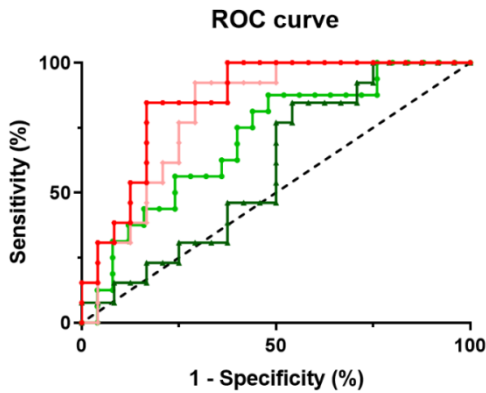
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Tsai et al, Journal of Personalized Medicine, 2021

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SKNA配合HRV來預測昏厥



以SKNA合併HRV參數SDNN
來作為昏厥的預測!

ROC 曲線下面積高達 0.859!!

— SKNA-SDNN index: AUROC, 0.859; 95% CI, 0.740-0.978; $p < 0.001$

— Tilt-up/Rest SDNN: AUROC 0.814; 95% CI, 0.678-0.951; $p = 0.002$

— Rest aSKNA: AUROC 0.708; 95% CI, 0.547-0.868; $p = 0.027$

— Rest SDNN: AUROC 0.596; 95% CI, 0.412-0.781; $p = 0.340$

Tsai et al, Journal of Personalized Medicine, 2021

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未來展望

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SKNA更多的應用

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- 病情的判斷
- 藥物治療的評估
- 手術效果的評估
- 個人化、精準醫療醫療

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感謝

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謝謝您的專注聆聽!



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