Sports Cardiology: Athletes' Heart
Jun 24 (Sat) 07:00-08:30

Management of SCD on the Pitch

Yoo Ri Kim

Associate professor of Cardiology, Department of Internal Medicine,
Chonnam National University, College of Medicine, Gwangju,
South Korea

Korean Heart Rhythm Society
COI Disclosure

Yoo Ri Kim:

The authors have no financial conflicts of interest to disclose concerning the presentation

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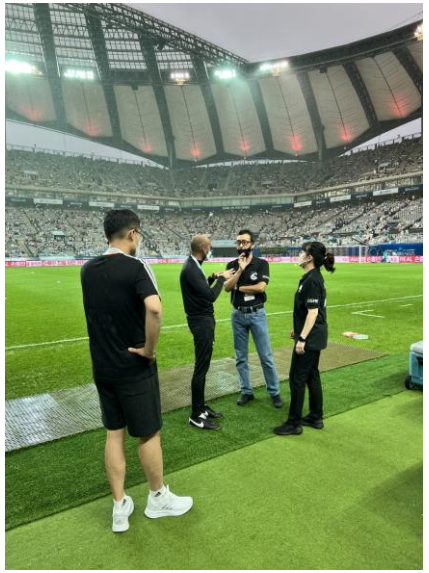
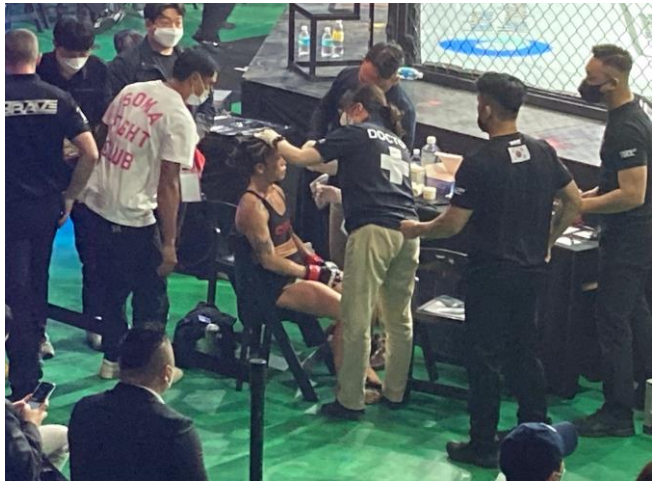




Why Sports Cardiology?

Increasing interest in “Sports for all”

1. Recognition : any collapses without contact

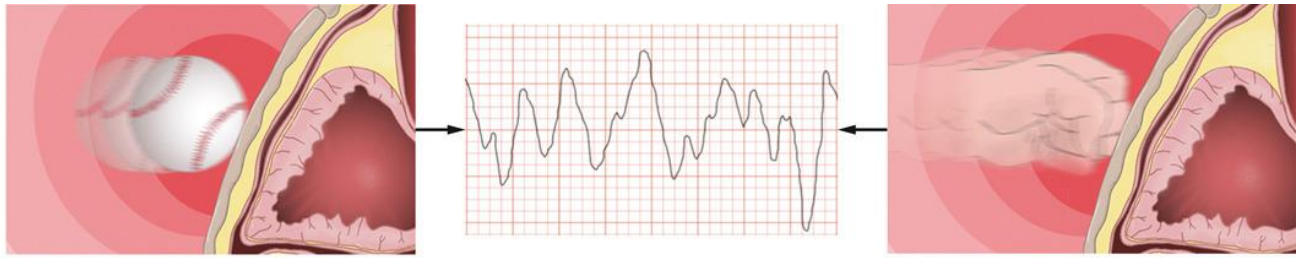
Sudden cardiac death in athletes: the Lausanne recommendations.
Eur J Cardiovasc Prev Rehabil 2006

No.	Year	Gender	Age	Sport		Outcome	Intensity level**	Inter-vention	Time for intervention		Associated signs of SCA				High into Low activity
			Young* Middle Old	Type	Professional Amateur	SCA SCD			Delayed*** Quick	in seconds or from statements	Seizure-like move-ments	Agonal respi-ration	Prone posi-tion	Eyes wide open/ rolled back	
1	1990	Male	Y	Basket	Professional	SCD	Low	None			Seizures	Agonal R			H --> L
2	1993	Male	Y	Basket	Professional	SCA	Moderate	Spontan. recovery							
3	1998	Male	Y	Ice hockey	Professional	SCA	CC****	Spontan. recovery						Eyes abnorm	
4	2003	Male	Y	Soccer	Professional	SCD	Low	Unknown - Video censored				Agonal R	Prone	Eyes abnorm	
5	2004	Male	Y	Soccer	Professional	SCD	Low	CPR	Delayed	75 - 150 sec		Agonal R			H --> L
6	2004	Male	M	Wrestling	Professional	SCA	High	Unknown				Agonal R		Eyes abnorm	
7	2004	Male	Y	Soccer	Professional	SCD	Low	CPR	Quick	25 - 30 sec		Agonal R			H --> L
8	2006	Male	Y	soccer	Professional	SCA	Unknown	None			Seizures	Agonal R			
9	2007	Male	Y	Soccer	Professional	SCD	High	Spontan. recovery							
10	2007	Male	M	Soccer	Professional	SCA	CC	Precordial thump	Quick	15 - 20 sec					
11	2008	Male	Y	Soccer	Professional	SCA	Low	CPR	Quick	40 - 70 sec	Seizures	Agonal R	Prone	Eyes abnorm	
12	2008	Male	Y	Soccer	Professional	SCA	Low	Spontan. recovery			Seizures		Prone	Eyes abnorm	H --> L
13	2009	Male	Y	Karate	Amateur	SCD	CC	Unknown							
14	2009	Male	Y	Soccer	Professional	SCA	Low	ICD shock	Quick	5 - 10 sec					
15	2009	Male	Y	Ice hockey	Professional	SCA	Low	CPR	Quick	Statements			Prone		H --> L
16	2010	Male	Y	Soccer	Professional	SCA	Low	CPR + defib	Quick	30 - 50 sec			Prone		
17	2010	Male	Y	Soccer	Professional	SCD	Low	None					Prone		
18	2010	Male	M	Basket	Amateur	SCA	Unknown	CPR + defib	Delayed	Statements	Seizures	Agonal R			
19	2011	Male	Y	Soccer	Professional	SCA	High	CPR + defib	Quick	Statements	Seizures			Eyes abnorm	
20	2012	Male	Y	Soccer	Professional	SCD	Unknown	CPR + defib	Unknown					Eyes abnorm	
21	2012	Male	Y	Soccer	Professional	SCD	Moderate	CPR	Delayed	> 60 sec		Agonal R	Prone		
22	2012	Male	Y	Soccer	Professional	SCA	Low	CPR + defib	Quick	Statements			Prone		
23	2013	Male	O	Basket	Amateur	SCA	Low	CPR + defib	Quick	Statements					H --> L
24	2013	Male	Y	Volleyball	Amateur	SCD	Low	Unknown							H --> L
25	2014	Male	Y	Icehockey	Professional	SCA	Low (on be	CPR + defib	Quick	Statements					
26	2014	Male	Y	Taekwondo	Professional	SCD	Moderate	Unknown, none seen at least 1st min							H --> L
27	2015	Male	Y	Soccer	Professional	SCD	Low	None				Agonal R			
28	2015	Male	Y	Marathon	Amateur	SCA	Unknown	CPR + defib	Unknown						
29	2015	Male	Y	Gymnastics	Amateur	SCA	Moderate	CPR	Quick	Statements		Agonal R	Prone	Eyes abnorm	
30	2016	Male	Y	Soccer	Professional	SCD	Low	None							
31	2016	Female	Y	Volleyball	Amateur	SCA	Low	CPR + defib	Quick	Statements					H --> L
32	2016	Male	Y	Soccer	Professional	SCD	Moderate	None			Seizures				
33	2016	Male	O	Cycling	Amateur	SCA	Low	CPR	Delayed	240 sec		Agonal R			
34	2016	Male	M	Marathon	Amateur	SCA	Moderate	CPR+defib	Quick	Statements			Prone		
35	2017	Male	Y	Soccer	Professional	SCA	Low	CPR	Delayed	> 300 sec					
										SUM	7 (20%)	12 (34%)	10 (29%)	8 (23%)	9 (26%)

Br J Sports Med 2019;53:1293–1298.

Direct blow or impact to the chest

Commotio Cordis



	Sport-Related (64% of all Cases)			Non-Sport-Related (36% of all Cases)		
Setting*	Baseball (45%)	Softball (11%)	American football (9%)	Assault (76%)	Motor Vehicle Accidents (7%)	Daily activities (16%)‡
Impact	94% projectiles			5% projectiles		
Sex & Age†	98% male 16 (9-47) years			87% male 20 (1-60) years		
Resuscitation	↑ rates of CPR (97%) ↑ rates of defibrillation (81%) ↓ time to resuscitation			↓ rates of CPR (27%) ↓ rates of defibrillation (17%) ↑ time to resuscitation		
Outcome	66% mortality			88% mortality		

*Top 3 commonest sports/settings from left to right
†Median age (range)
‡Including falls, play fighting (in children) and occupational accidents. See text for further details.

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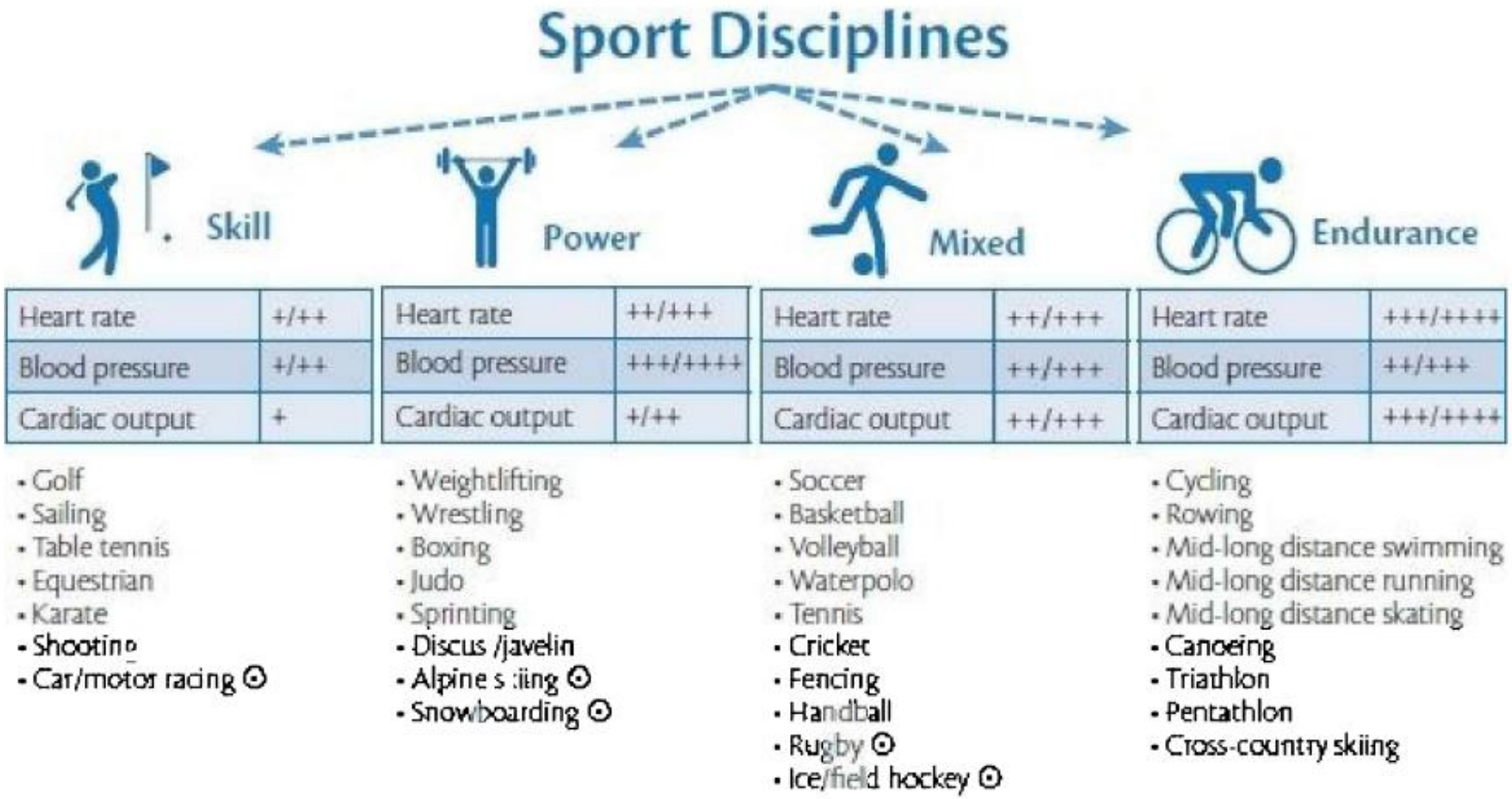


Fig. 7.1.1 Schematic classification of different sports. Symbol indicates sport with increased risk of bodily collision.

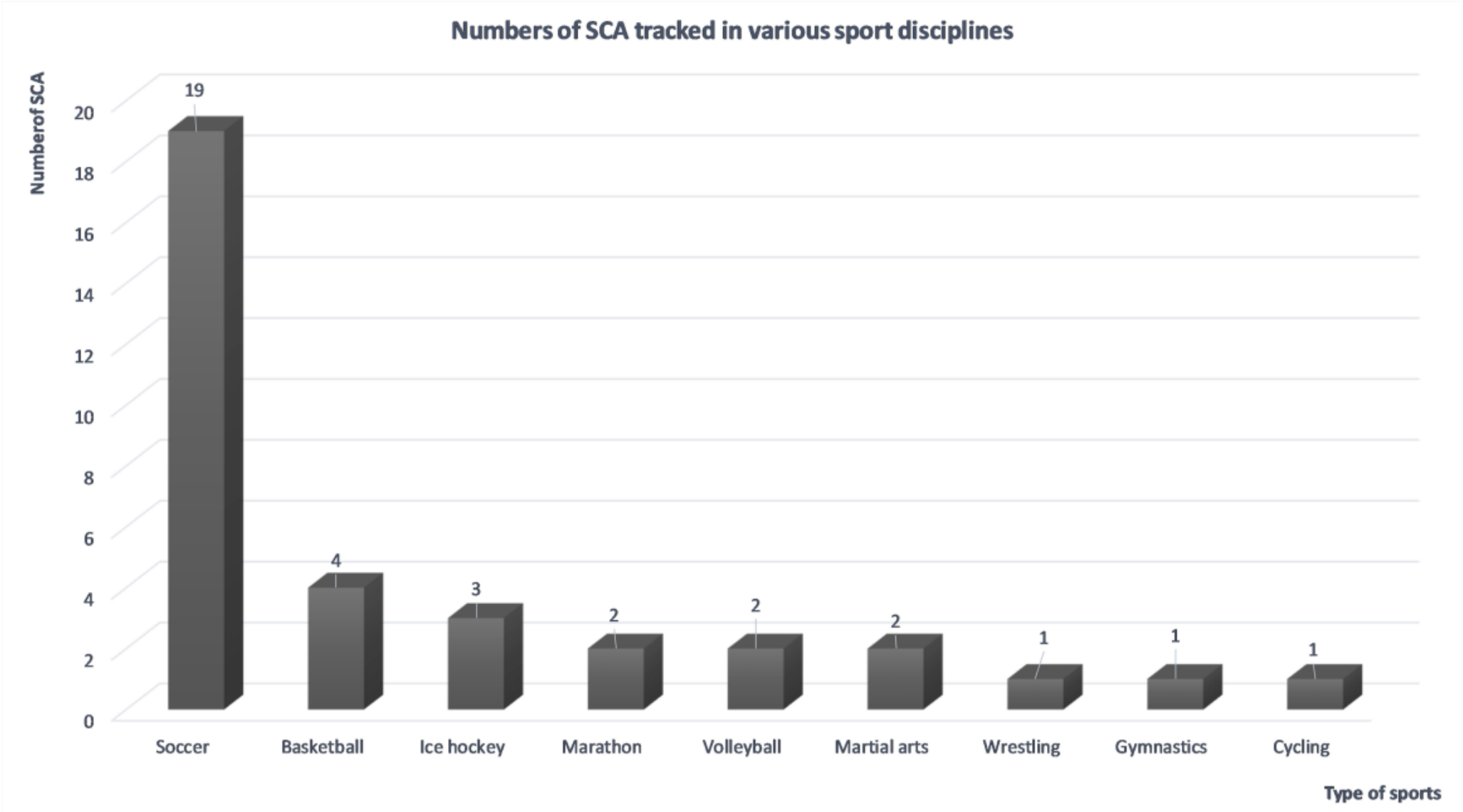


Figure 1 Diagram presenting numbers of sudden cardiac arrests (SCA) tracked in the various sports disciplines from researching online video databases.

Br J Sports Med 2019;53:1293–1298.

2. Emergency action plan: a preplanned, pre-rehearsed

2. Emergency action plan: make a room for CPR

- Young-Rok Shin Korean Soccer player 2011 – Brugada syndrome
  - Collapse on the pitch
  - CPR for 10 mins -> VF at ER -> Defib 4 times
  - Became conscious in 50 days

3. Resuscitation on the field (ACLS + AED)

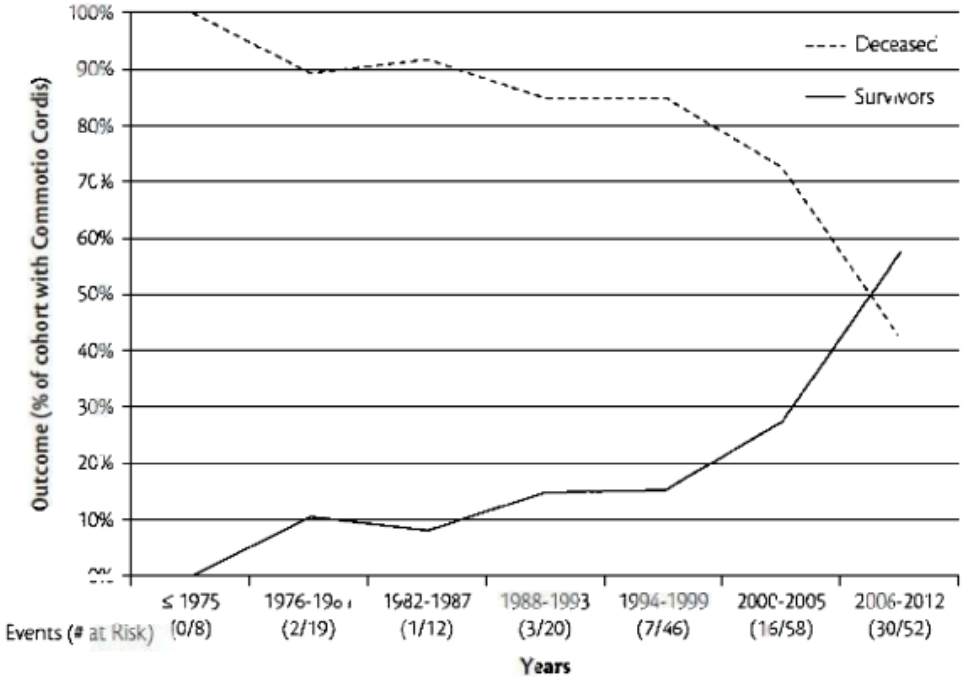
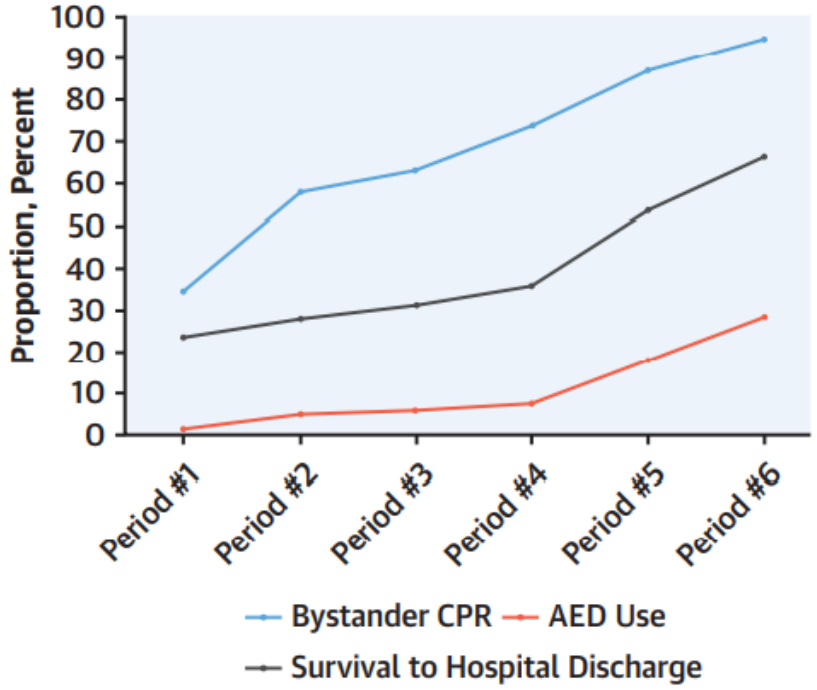


Fig. 9.1.1 Resuscitation in the commotio cordis registry has improved from less than 5% to over 60%. This improvement is probably a result of both improved recognition of sudden cardiac arrest and resuscitiation.
Reprinted from *Heart Rhythm*, Volume 10, Issue 2. Barry J. Maron, Tammy S. Haas, Aneesha Ahluwalia, Ross F. Garberich, N.A. Mark Estes, Mark S. Link. Increasing survival rate from commotio cordis, pp.219–223. Copyright (2013) with permission from Elsevier.

FIGURE 1 Temporal Trends Through the Six 2-Year Periods of Time (2005-2018)



There was a steady increase in the rates of bystander CPR and AED use, together with a 3-fold increase in survival rate. AED = automated external defibrillator; CPR = cardiopulmonary resuscitation.

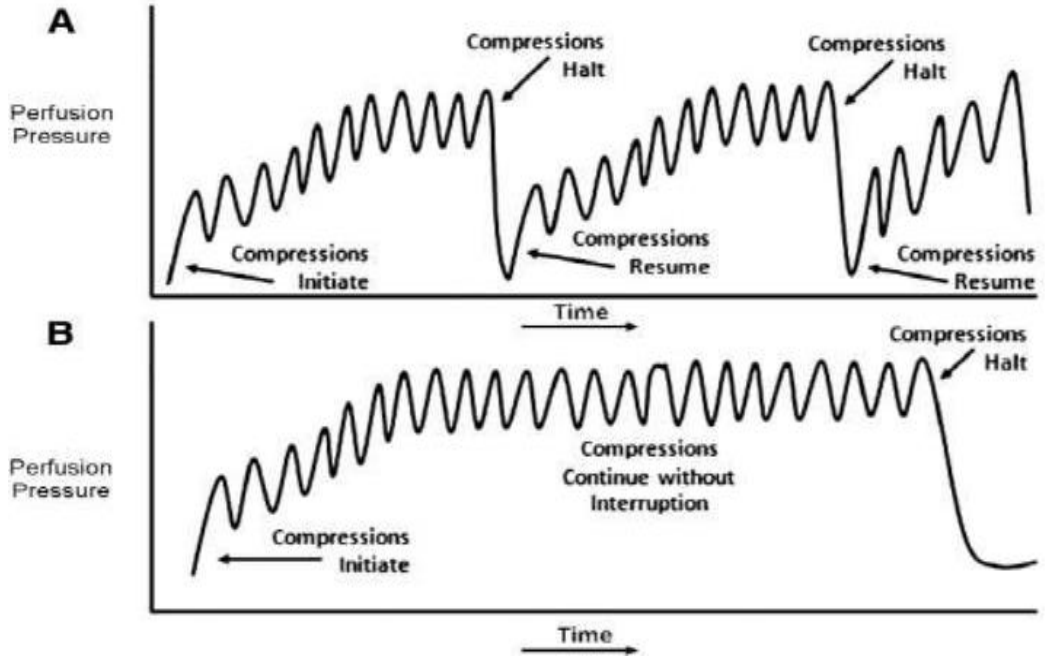
Not too fast;

100-120/min

Coronary Perfusion and ROSC

A well perfused myocardium is more likely to experience return of spontaneous circulation (ROSC)

Perfusion During Cardiac Arrest with Chest Compressions

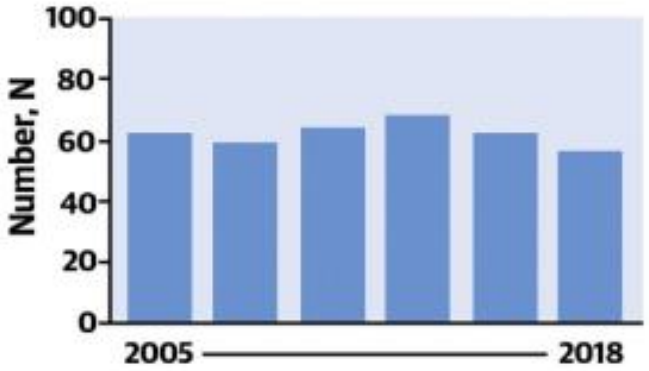


Similar Frequency

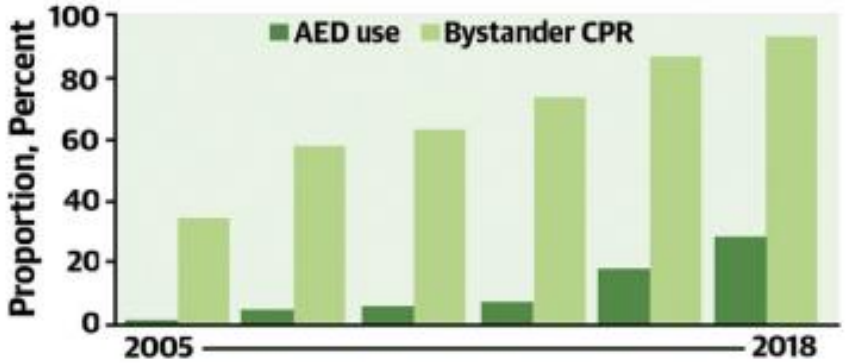
Improved Management

Higher Survival

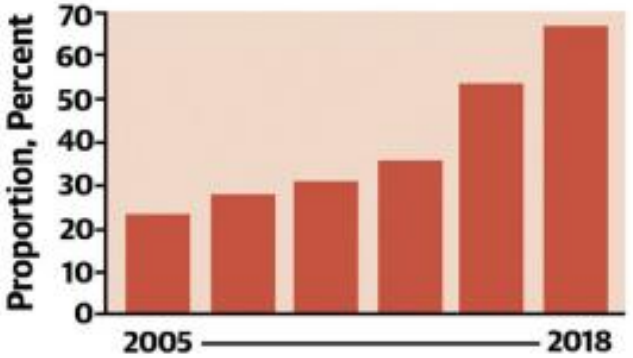
Total Number of SrSCA



AED Use and Bystander CPR



Survival to Discharge



Karam, N. et al. J Am Coll Cardiol. 2022;79(3):238-246.

- Eriksen Euro 2020(‘21) - VF
  - 0:12 collapse
  - 0:18 notification – Dr. call
  - 0:33 Team doctor arrived
  - 1:01 airway, head & neck exam
  - 1:26 EMT arrived
  - 1:53-2:00 repositioning
  - 2:04 CPR started
  - 3:30 AED - one defib!
  - 3:47 CPR restarted

Cardiac safety at sport events: the medical action plan

- Unique characteristics of sport mass gathering emergency medical care
- Need to navigate large crowds and architectural barriers (fences, lifts, ramps, etc.) prevent use of motorized transport
- Patients refusing to receive medical care and hostility from surround spectators or between rival fans complicate the working

Barriers

Fig. 9.2.1 Large arena, full-capacity crowd.

Fig. 9.2.4 EMS map of a football stadium with a capacity of 80,000 spectators.

Fig. 9.2.6 Equipment for medical room.

Fig. 9.2.5 Medical personnel.

Fig. 9.2.2 Stairs and other obstacles may be present in the arena.

Fig. 9.2.8 Signs showing the location of the medical rooms.

Previous ICD saved the player's life

- Anthony Van Loo
- 0:05 collapse
- 0:10 Team doctor arrived
- 0:11 ICD shock
- 0:16 survived

- In 2008, 20-year-old had ICD d/t Inherited arrhythmia syndrome
- In 2009 after collapsing on the pitch during a match, ICD shock revived him
- In May 2018 Van Loo collapsed again in a match.
- In November 2018 he concluded, after a medical visit, that although his recovery was going well, he would never be able to return to his former level of play, leading him to announce his retirement from football.


10
LOD
8
BRATHWAITE
9
DEFIBRILLATOR
IPAD

Near Term Prevention

Warning Symptoms

+

Connected Devices

+

Artificial Intelligence

Improvement in SCA Outcomes

Decreased Delay for Resuscitation

+

Decreased Delay for Medical Contact

+

Referral to Appropriate Level of Healthcare Expertise

1 Optical-based tracking system

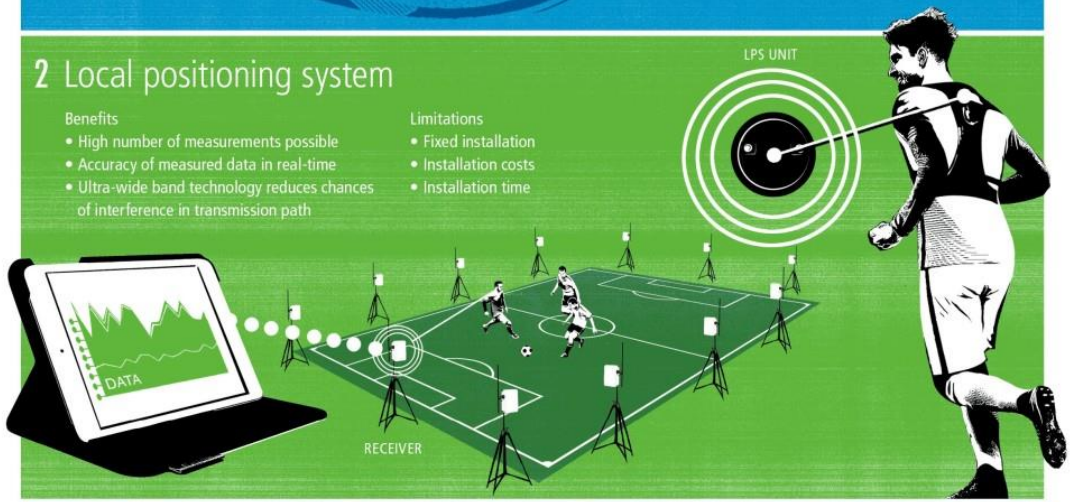
Benefits
- Non-invasive to players
- Commonly used in the football market
- High sampling rate, ball tracking possible

Limitations
- Limited number of measurements
- Tracking occlusions require manual corrections
- Installation time

2 Local positioning system

Benefits
- High number of measurements possible
- Accuracy of measured data in real-time
- Ultra-wide band technology reduces chances of interference in transmission path

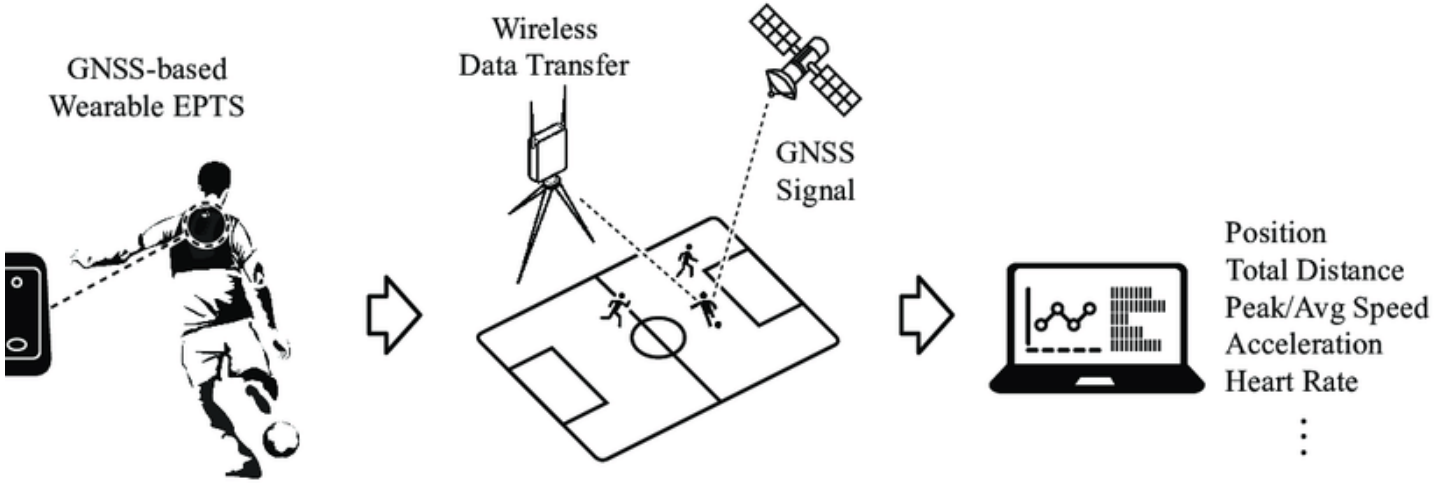
Limitations
- Fixed installation
- Installation costs
- Installation time

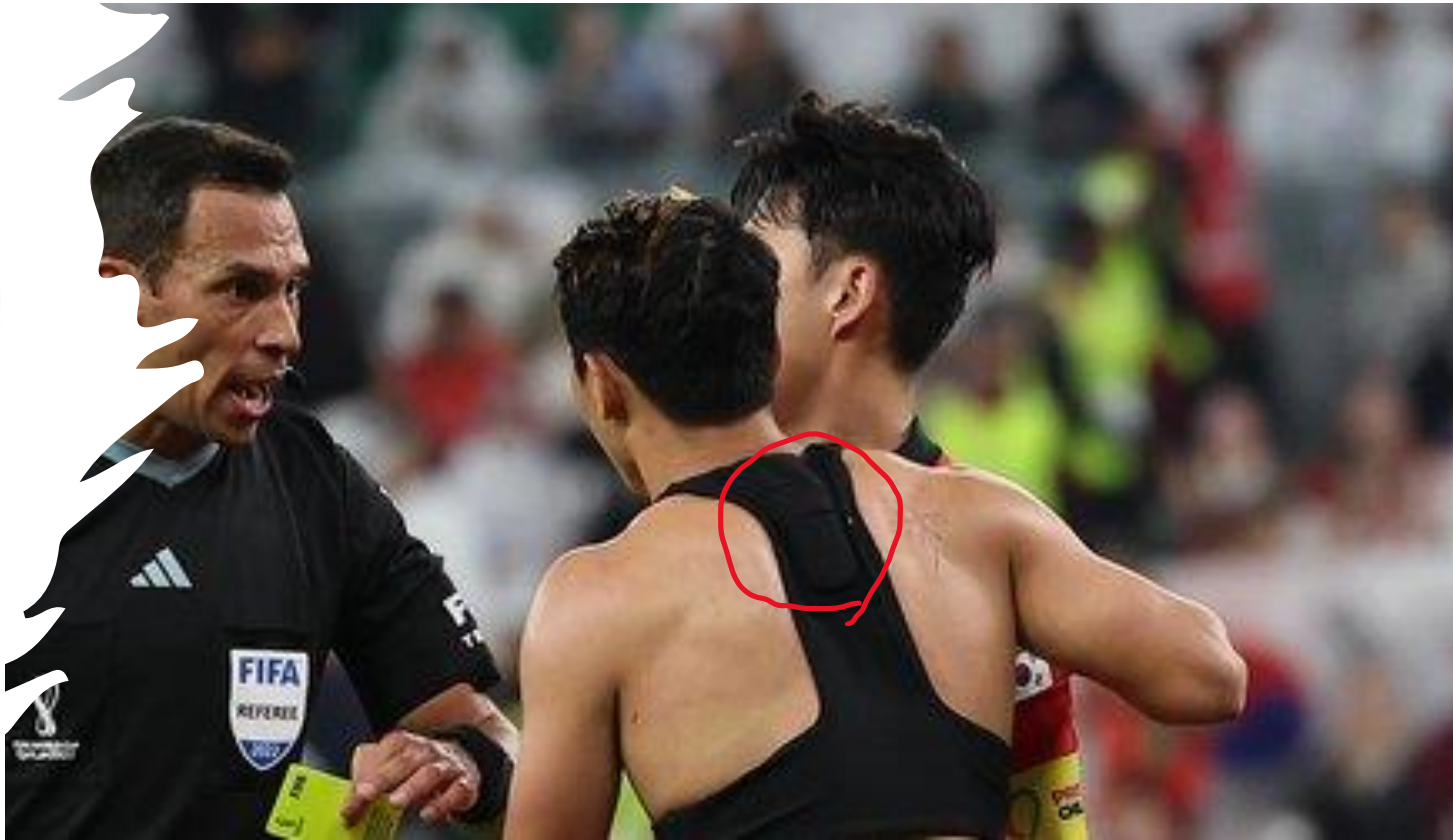


3 GPS/GNSS satellite system

Benefits
- High number of measurements possible
- Short installation time
- Operator not needed

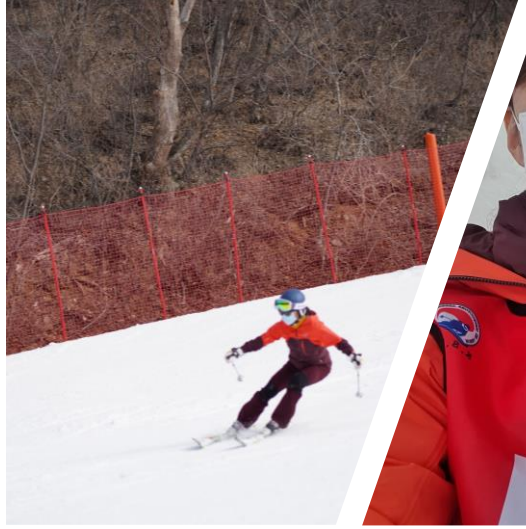
Limitations
- Device attached to player and device size are issues for matchday usage
- Satellite signal line of sight in stadium
- Accuracy concerns of measured data

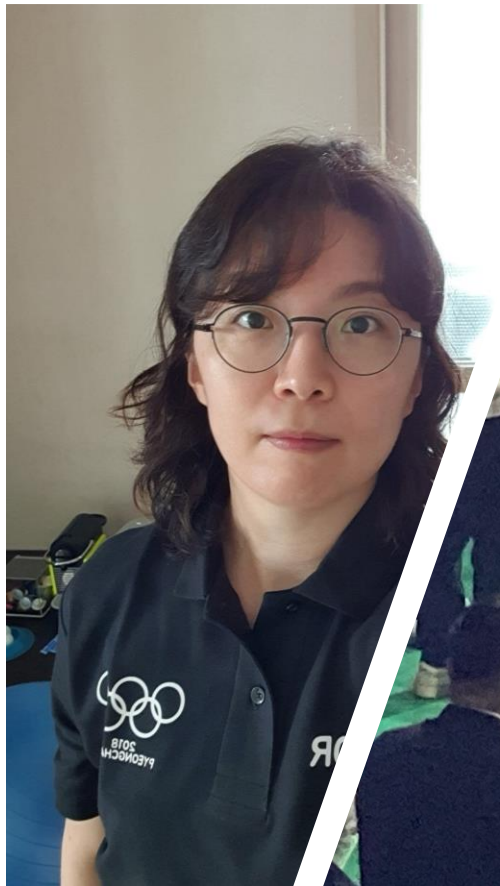




Take home messages

- Etiology of SrSCD
  - Younger age : Coronary anomaly > cardiomyopathy
  - Older age : coronary artery disease (more stable plaque)
  - SUD : molecular autopsy Inherited arrhythmia syndrome (BrS)
- Preplanned emergency action plan
- First, Recognition (player, referee,
- Second, If it is happened, Basic CPR + AED within a 3 minute
- Post assessment and rehabilitation (ICD) for RTP
- Future direction : video tracking system, device with AI





Thank you!

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