

JOURNÉES
NATIONALES
DU **G.E.R.S**

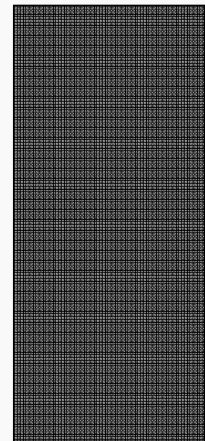


RENNES
Roazhon Park
29 & 30
SEPTEMBRE **2016**

L'indispensable sur le cœur d'athlète

LE VENTRICULE GAUCHE DE L'ATHLÈTE

STÉPHANE CADE, Montpellier

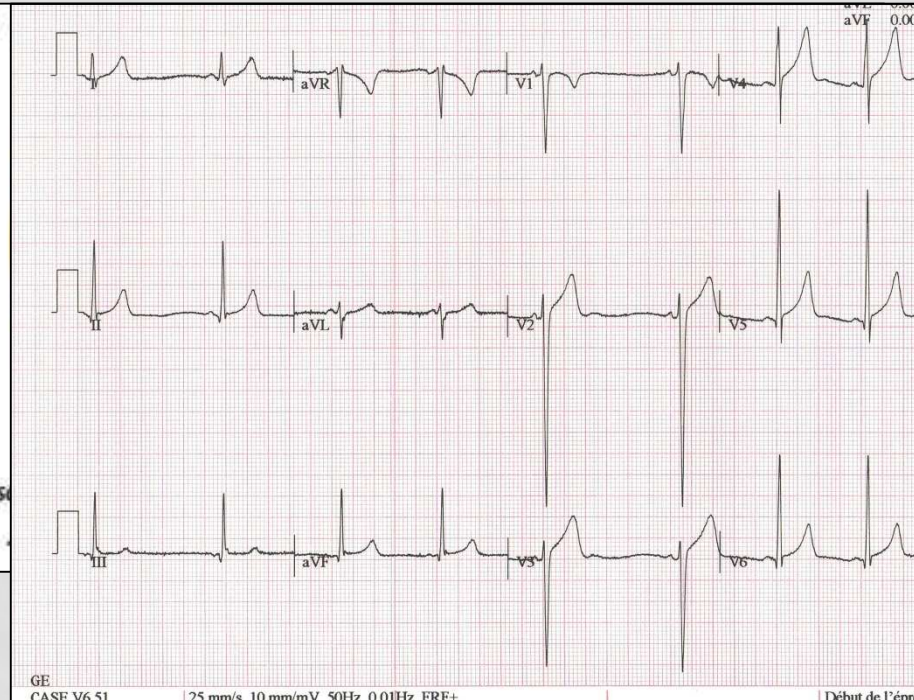


Le VG de l'athlète est le plus souvent un VG normal

Refined Criteria Training Related Normal Variants
Not Warranting Further Investigation*

- Sinus bradycardia
- First-degree AV block
- Incomplete RBBB
- Early repolarisation
- Isolated QRS voltage criteria for LVH

If present in IS



**Redéfinition de la
Classification de
« Seattle »**

*Sheikh et Al.
Circulation. 2014
22;129(16):1637-49*

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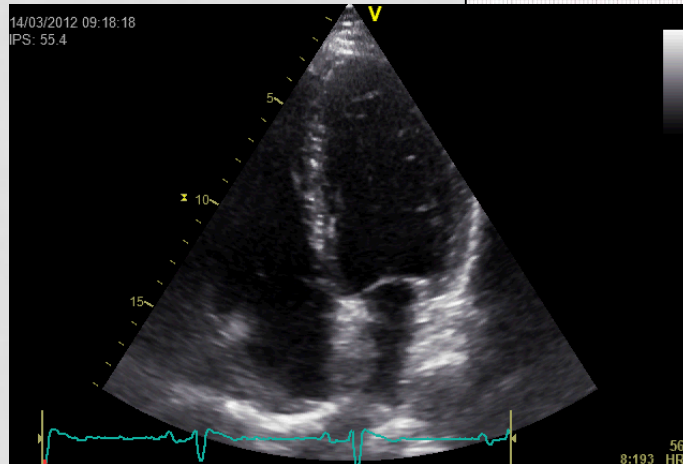
- Sinus bradycardia
- First-degree AV block
- Incomplete RBBB
- Early repolarisation
- Isolated QRS voltage criteria for LVH

If present in 15%



Redéfinition de la
Classification de
« Seattle »

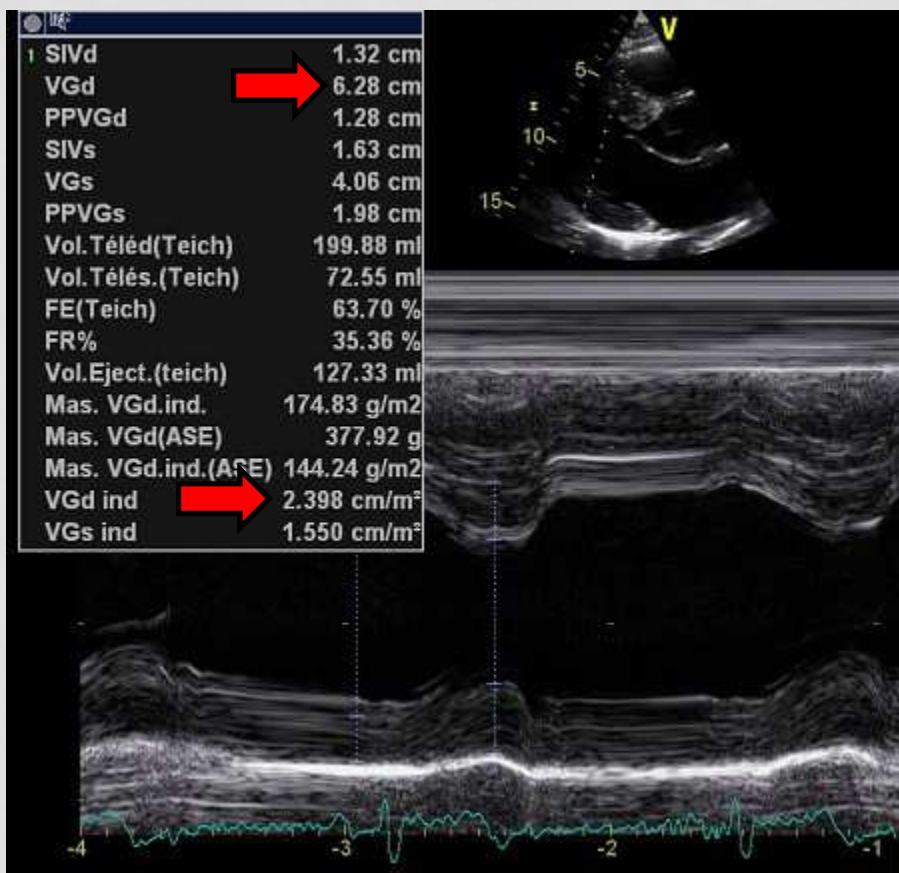
*Sheikh et Al.
Circulation. 2014
22;129(16):1637-49*



Normal oui mais ...

Rugby, 2,03 m pour 125 kg

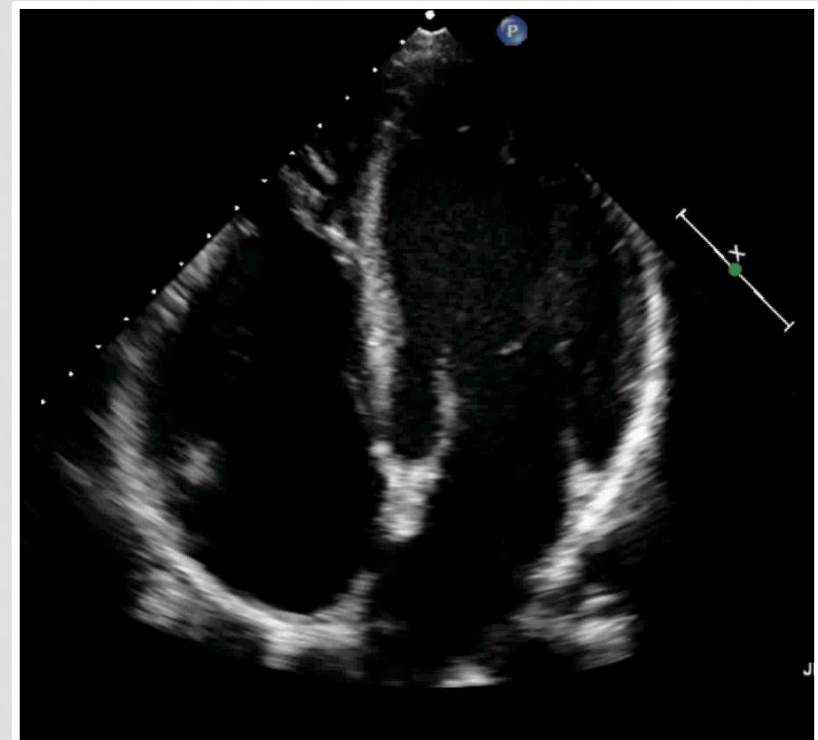
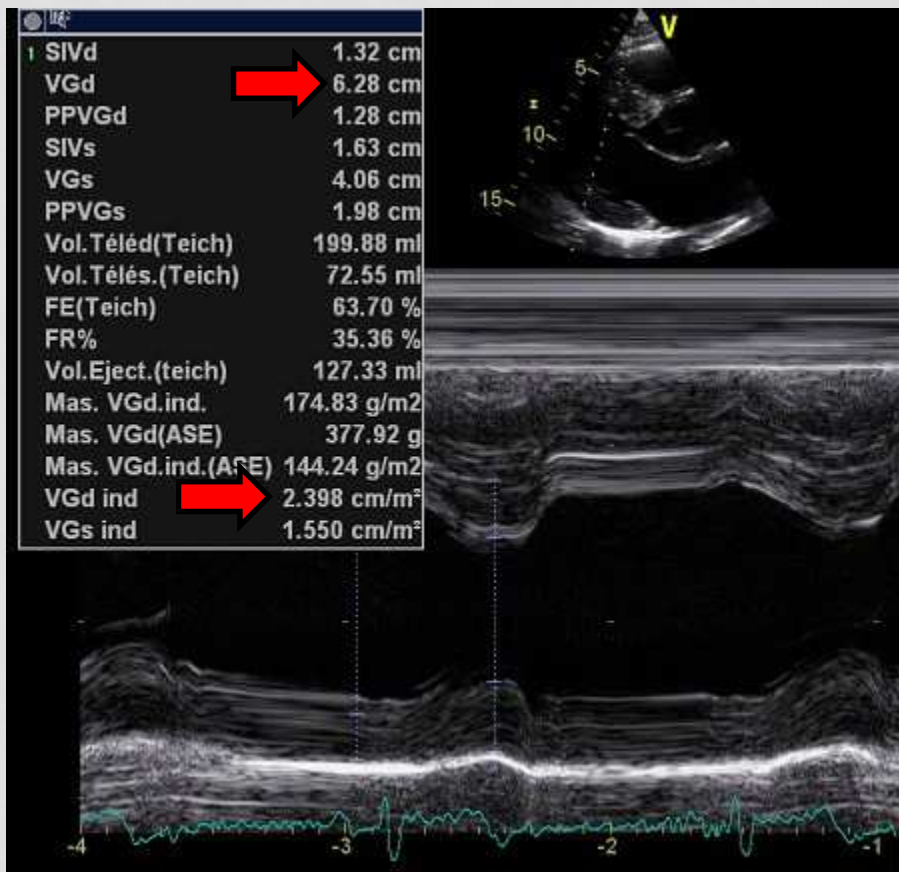
Dilatation du ventricule gauche



Normal oui mais ...

Rugby, 2,03 m pour 125 kg

Dilatation du ventricule gauche



Hypertrophie / Dilatation
harmonieuse

Parlons d'athlète

ENTRAÎNEMENT, 6-8H /sem, > 6 mois, > 60% VO₂ Max,
ASYMPTOMATIQUE, PERFORMANT avec VO₂ CORRÉLÉE



Demographics and Clinical Parameters	ER (n = 20)	SR (n = 20)	Control (n = 20)	P ^a Value
Age (yr)	25 ± 3*,†	20 ± 2	21 ± 2	<0.001
Height (cm)	197 ± 5*,†	186 ± 6†	177 ± 6	<0.001
Weight (kg)	98 ± 5*,†	82 ± 10	78 ± 9	<0.001
BSA	2.3 ± 0.1*,†	2.1 ± 0.2	2.0 ± 0.1	<0.001
Resting pulse (beats·min ⁻¹)	56 ± 7†	60 ± 5†	72 ± 8	<0.001

Parlons d'athlète

ENTRAÎNEMENT, 6-8H /sem, > 6 mois, > 60% VO2 Max,
ASYMPTOMATIQUE, PERFORMANT avec VO2 CORRÉLÉE



Demographics and Clinical Parameters	ER (n = 20)	SR (n = 20)	Control (n = 20)	P ^a Value
Age (yr)	25 ± 3*,†	20 ± 2	21 ± 2	<0.001
Height (cm)	197 ± 5*,†	186 ± 6†	177 ± 6	<0.001
Weight (kg)	98 ± 5*,†	82 ± 10	78 ± 9	<0.001
BSA	2.3 ± 0.1*,†	2.1 ± 0.2	2.0 ± 0.1	<0.001
Resting pulse (beats·min ⁻¹)	56 ± 7†	60 ± 5†	72 ± 8	<0.001
Recent training volume (h·wk ⁻¹)	22 ± 6*,†	11 ± 4†	1 ± 1	<0.001
Endurance (h·wk ⁻¹)	19 ± 4*,†	9 ± 2†	0 ± 1	<0.001
Strength (h·wk ⁻¹)	3 ± 1	2 ± 1	0 ± 1	

Baggish et al. Med Sci Sports Exerc 2010

Parlons d'athlète

Parameter	ER (n = 20)	SR (n = 20)	Control (n = 20)	P ^b Value
LA volume (mL)	75 ± 17*,†	62 ± 13†	46 ± 7	<0.001
IVS (mm)	12.6 ± 0.9*,†	10.6 ± 0.7†	9.5 ± 0.8	<0.001
PWT (mm)	12.7 ± 1.5*,†	10.5 ± 0.6†	9.6 ± 0.7	<0.001
LVEDV (mL)	171 ± 20*,†	140 ± 20†	125 ± 15	<0.001
LVESV (mL)	74 ± 12*,†	60 ± 8†	53 ± 9	<0.001
LV mass (g)	332 ± 45*,†	267 ± 31†	196 ± 23	<0.001



*Valeurs
indexées
à SC*

Parameter	ER (n = 20)	SR (n = 20)	Control (n = 20)	P ^b Value
LA volume (mL·m ⁻²)	32 ± 7†	32 ± 7†	24 ± 4	<0.001
IVS (mm·m ⁻²)	5.5 ± 0.3†	5.3 ± 0.5†	4.9 ± 0.3	<0.001
PWT (mm·m ⁻²)	5.4 ± 0.6†	5.4 ± 0.6†	4.9 ± 0.6	<0.001
LVEDV (mL·m ⁻²)	76 ± 6*,†	71 ± 8†	63 ± 7	<0.001
LVESV (mL·m ⁻²)	34 ± 4*,†	31 ± 5†	27 ± 4	<0.001
LV mass (g·m ⁻²)	150 ± 11*,†	134 ± 16†	102 ± 13	<0.001

VG + dilaté, ± épais

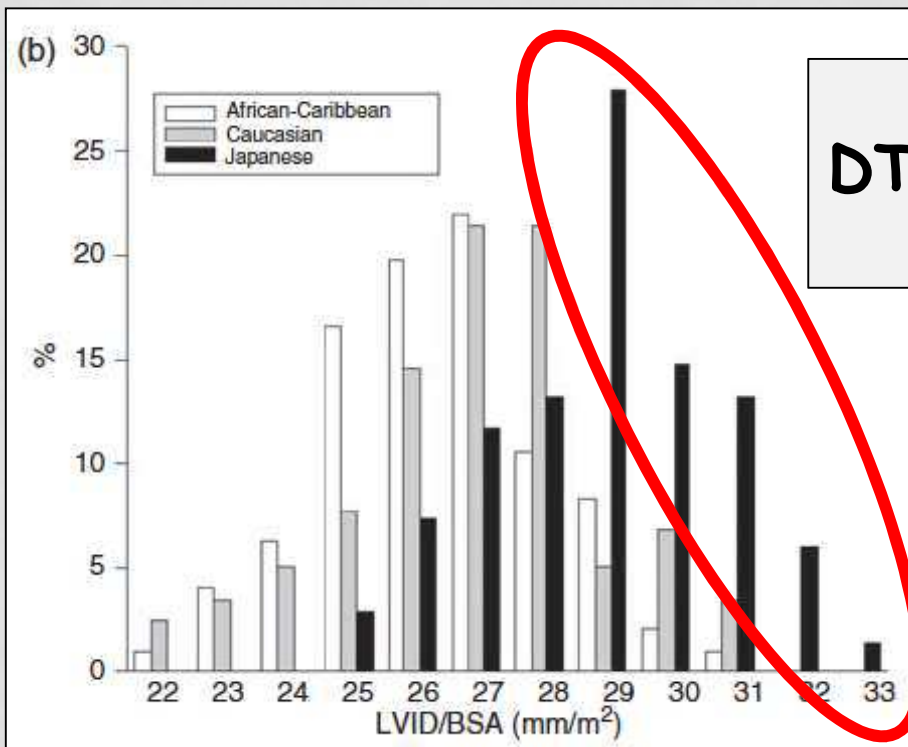


68 Japonais

Parlons
d'ethnie
et taille VG



96 Afro-caribéens



DTD VG

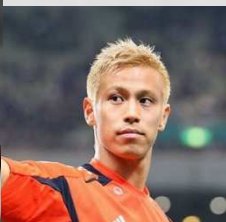
J: $55,2 \pm 3,3$
AC: $52,2 \pm 3,8$
C: $53,9 \pm 3,7$



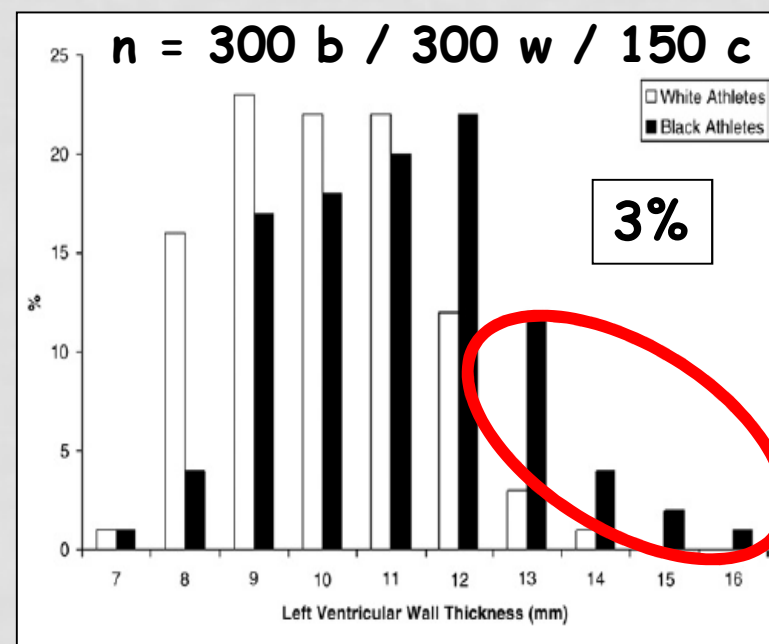
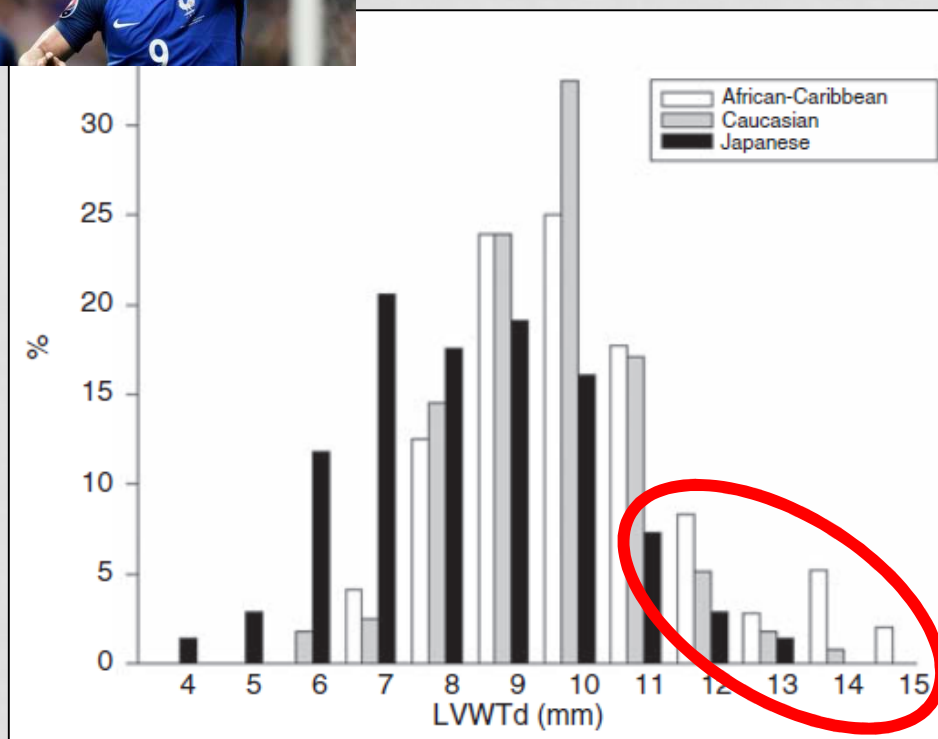
118 Caucasiens

Dtd VG indexé = ➡ chez japonais

Kervio et Al.
Eur. J. Prev. Cardiol. 2013



Parlons d'ethnie et épaisseur VG



Basavarajaiah JACC 2008

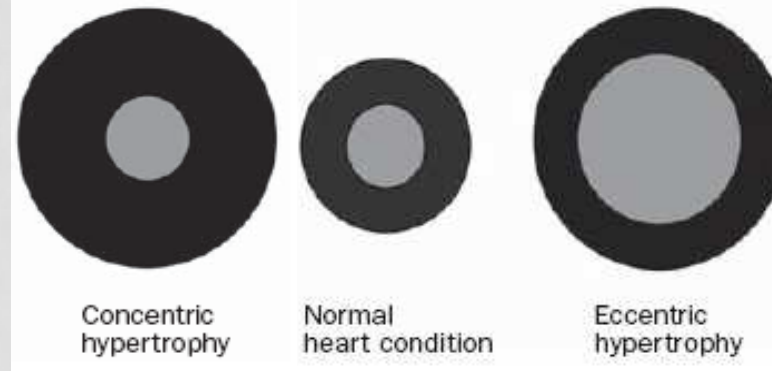
Ep. VG = ↗ chez Afro-caribéen

*Kervio et Al.
EJPC. 2013*

Increasing Static Component	Increasing Dynamic Component		
	A. Low (<50%)	B. Moderate (50-75%)	C. High (>75%)
	I. Low (<10%)	II. Moderate (10-20%)	III. High (>30%)
	Bowling Cricket Curling Golf Rifery Yoga	American football* Field events (jumping) Figure skating Rodeo** Rugby Running (sprint) Surfing Synchronized swimming* "Ultra" racing	Boxing Canoeing Kayaking Cycling* Decathlon Rowing Speed skating Triathlon* Basketball* Ice hockey* Cross-country skiing (skating technique) Lacrosse* Running (middle distance) Swimming Team handball Tennis

Parlons Type de sport

'Morganroth hypothesis'



*Effort
statique*
=
**travail
isométrique**

⇒ Surcharge
Pression



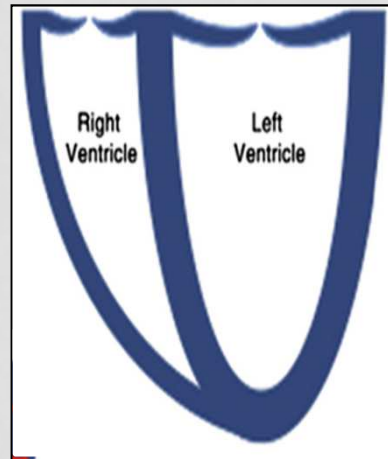
*Effort
dynamique*
=
**travail
isotonique**

⇒ Surcharge
Volume

Théorie très schématique et remise en question

Mihl C et al Netherlands Heart J 2008; 16:129-33

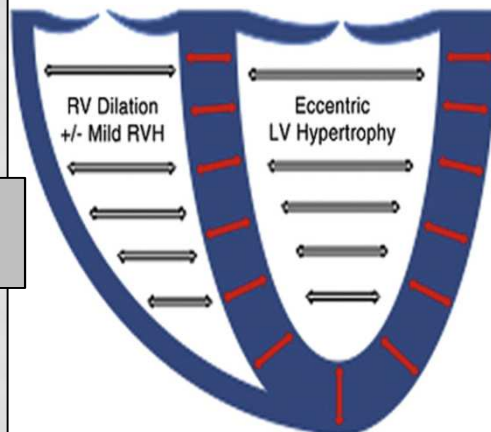
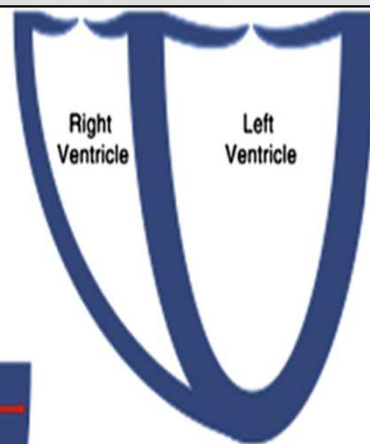
Cœur d'athlète et Zones grises



*Kim et Al.
Canadian J. Card
32 (2016) 429-37*

Cœur d'athlète et Zones grises

- modérée taille VG (VD)
- Bi-Atriale
- FEVG +/- ➡
- F° diastolique +

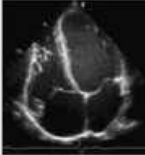
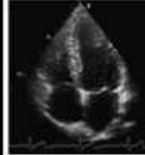
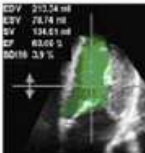
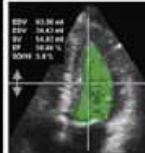


CMD ?

La Gerche JACC ci 2009

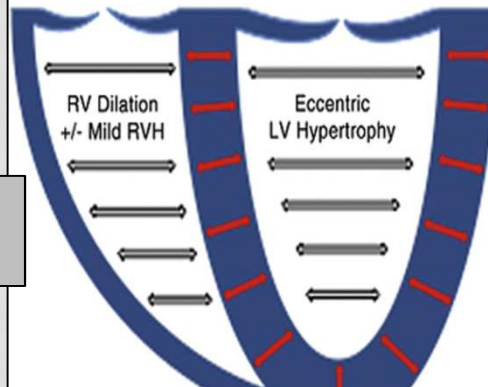
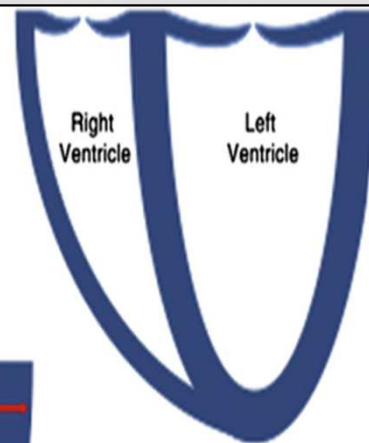
DTD > 60-65 mm

FE VG < 48%

	Athlete		Non-Athlete	
Left Ventricular Function				
Morphology		IVSd 8 - 16* mm < 13 mm LVIDd 49 - 73 mm < 65 mm LVM 113 - 618* g < 400 g		IVSd 6 - 10 mm LVIDd 42 - 59 mm LVM 88 - 224 g
Volumes/ EF(%)		LVEDV 130 - 260 ml < 240 ml EF 41 - 77% > 48%		LVEDV 67 - 155 ml EF >55%

Cœur d'athlète et Zones grises

- modérée taille VG (VD)
- Bi-Atriale
- FEVG +/- ➡
- F° diastolique +



CMD ?

ECG : Ondes Q, BBG, tb repol°

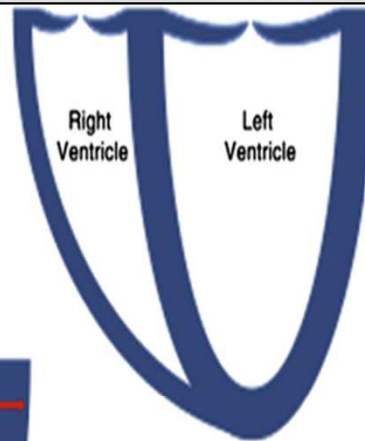
ETT: Dysf° diast ($e' < 8$ cm/s)
SGL < -15%,
➡ Rés. Contr à l'effort,

IRM (fibrose),
Holter ECG et EE aN

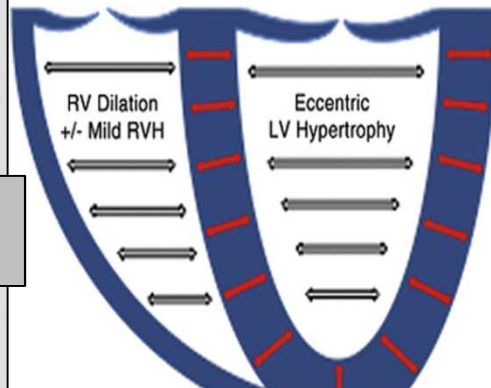
*Kim et Al.
Canadian J. Card
32 (2016) 429-37*

Cœur d'athlète et Zones grises

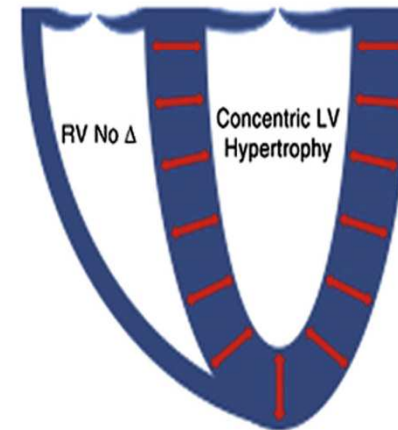
➤ modérée taille VG (VD)
 ➤ Bi-Atriale
 FEVG +/- ➡
 ➤ F° diastolique +



➤ modérée épaisseur VG
 ➤ +/- Bi-Atriale
 FEVG N
 ➤ F° diastolique N +/-



CMD ?



CMH ?

ECG : Ondes Q, BBG, tb repol°

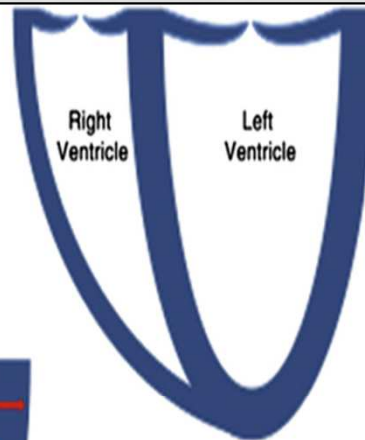
ETT: Dysf° diast ($e' < 8$ cm/s)
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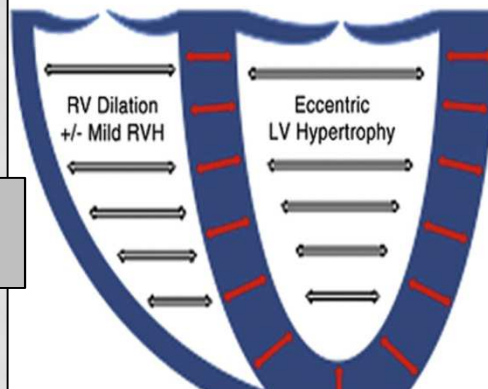
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Cœur d'athlète et Zones grises

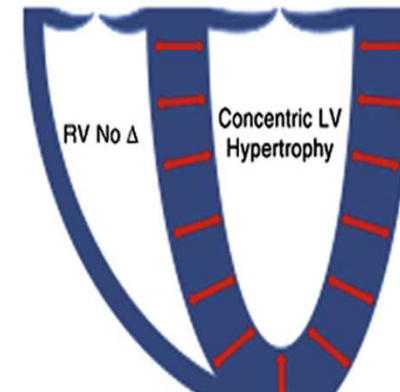
➤ modérée taille VG (VD)
 ➤ Bi-Atriale
 FEVG +/- ➡
 ➤ F° diastolique +



➤ modérée épaisseur VG
 ➤ +/- Bi-Atriale
 FEVG N
 ➤ F° diastolique N +/-



CMD ?



CMH ?

ECG : Ondes Q, BBG, tb repol°

ETT: Dysf° diast ($e' < 8$ cm/s)
 SGL < -15%,
 ➡ Rés. Contr à l'effort,

IRM (fibrose),
 Holter ECG et EE aN

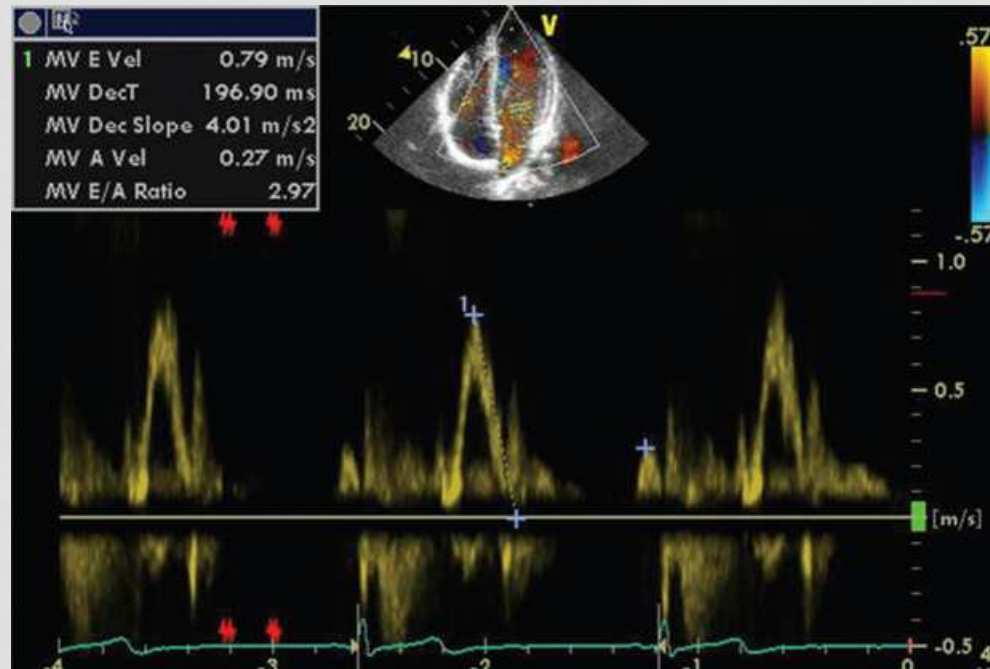
ECG : Ondes Q, tb repol° +

ETT: Dysf° diast ($e' < 8$ cm/s)
 Ep. > 16mm,
 SGL < -15%,

IRM (fibrose),
 Holter ECG et EE aN

Kim et Al.
 Canadian J. Card
 32 (2016) 429-37

Athlète et Fonction diastolique



Fonction diastolique normale ou « supra normale »

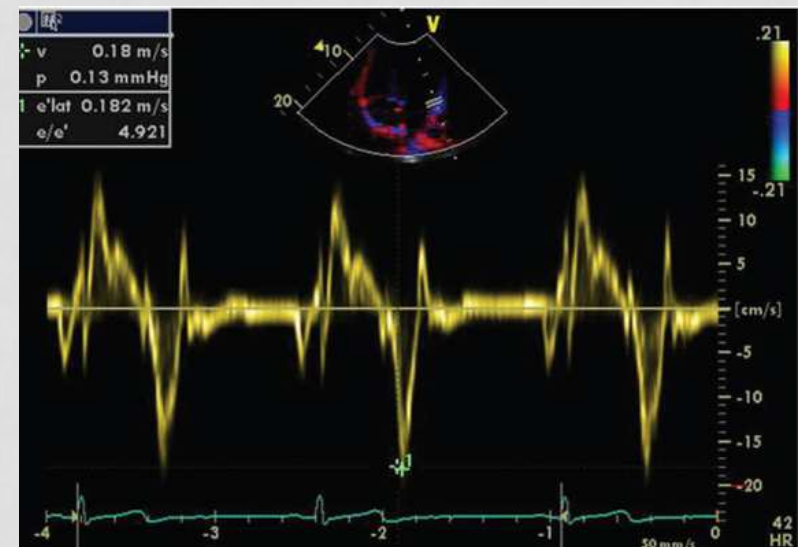
Surtout endurants

F° diastolique altérée dans CMH et CMD

1 145 Olympic athletes

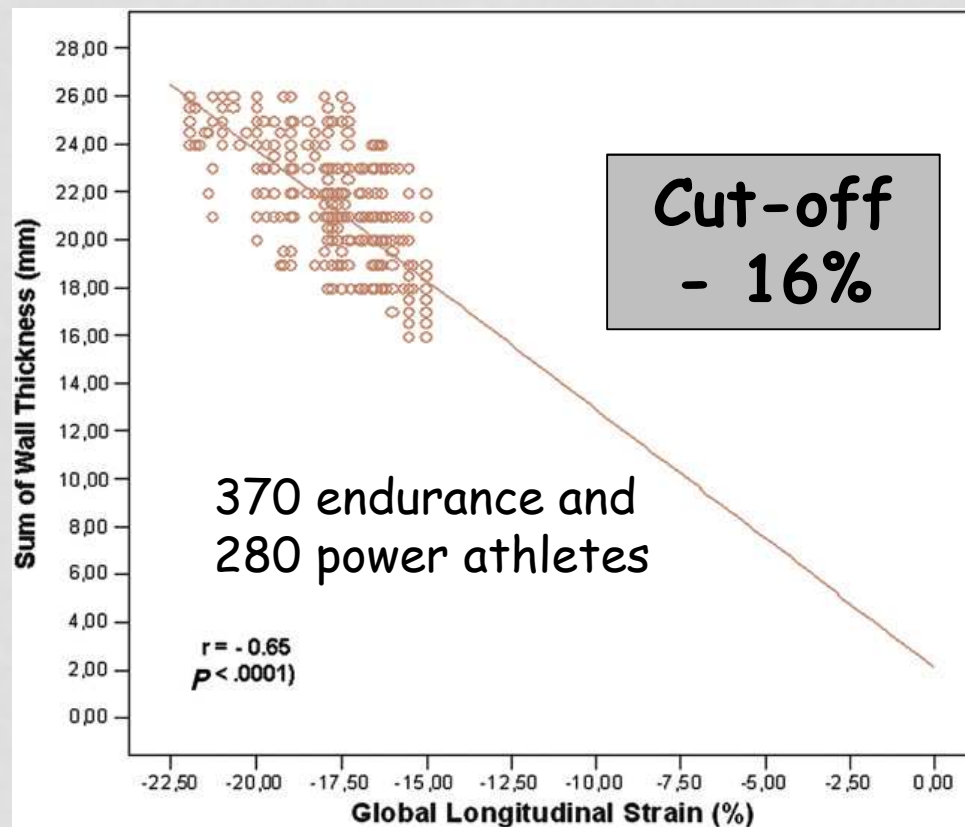
Variable	Athletes (n = 1,145)	Controls (n = 154)	P
PW E wave (cm/sec)	87 ± 15 (64-112)	89 ± 16 (65-118)	.134
PW A wave (cm/sec)	47 ± 10 (32-65)	56 ± 12 (39-78)	<.001
E/A ratio	1.93 ± 0.50 (1.27-2.85)	1.63 ± 0.35 (1.08-2.27)	<.001
DTI e' wave (cm/sec)	13.8 ± 2.2 (10.3-17.5)	16.2 ± 3.7 (10.6-22.6)	<.001
E/e' ratio	6.37 ± 1.20 (4.63-8.49)	5.72 ± 1.33 (3.98-8.02)	<.001

Caselli JASE 2015



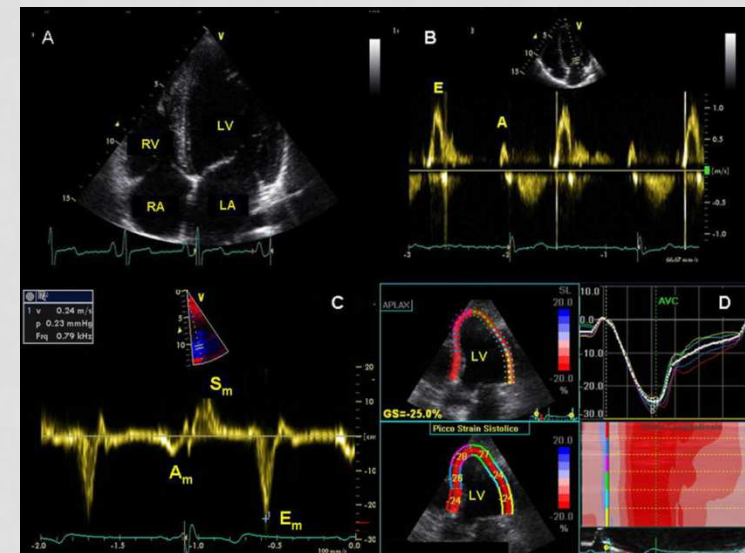
Cœur d'athlète et Déformations

	Lafitte (2007) PFP	Nottin (2008) Cyclists	Nottin (2009) Triathlete	D'Andrea (2010) Multiports	Galderisi (2010) Rowers	Simsek (2013) wres/run	Schattcke (2014) Marathons	Schmidt (2015) VFP
GLS	-17	-19	-19	-17,5	-22	-21 / -22	-22/-23	-20



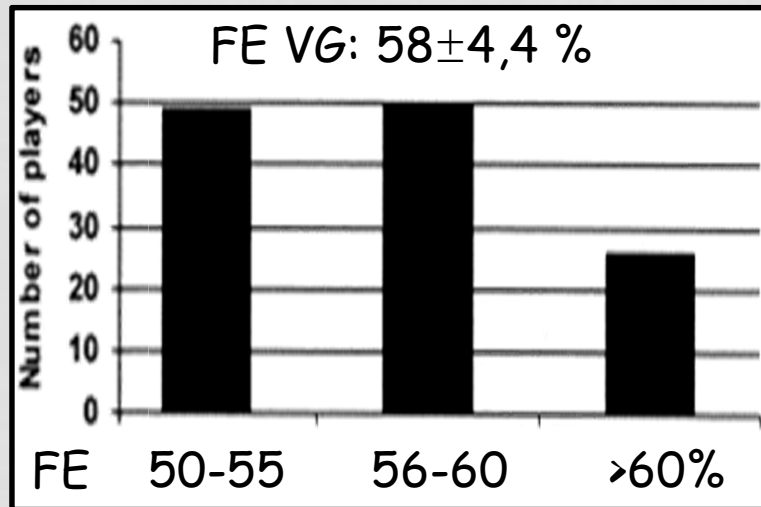
D'Andrea JASE 2010

*Valeur N strain
chez l'athlète*



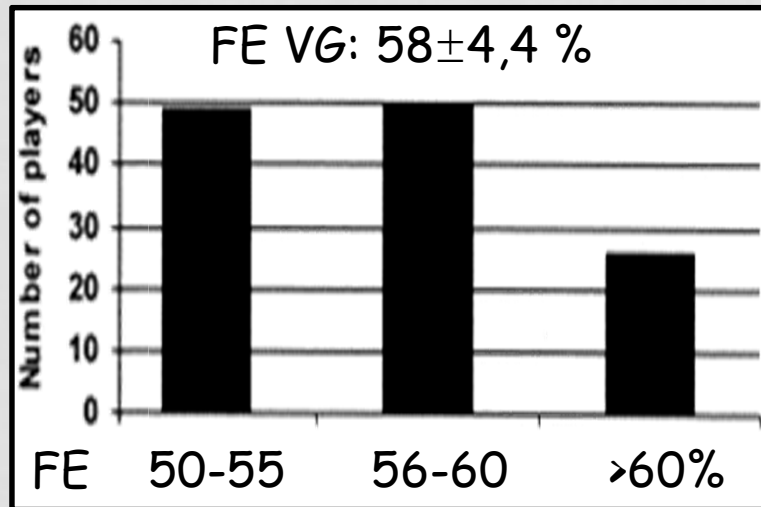
*Strain diminué
dans CMH et CMD*

Coœur d'athlète et Echo d'effort

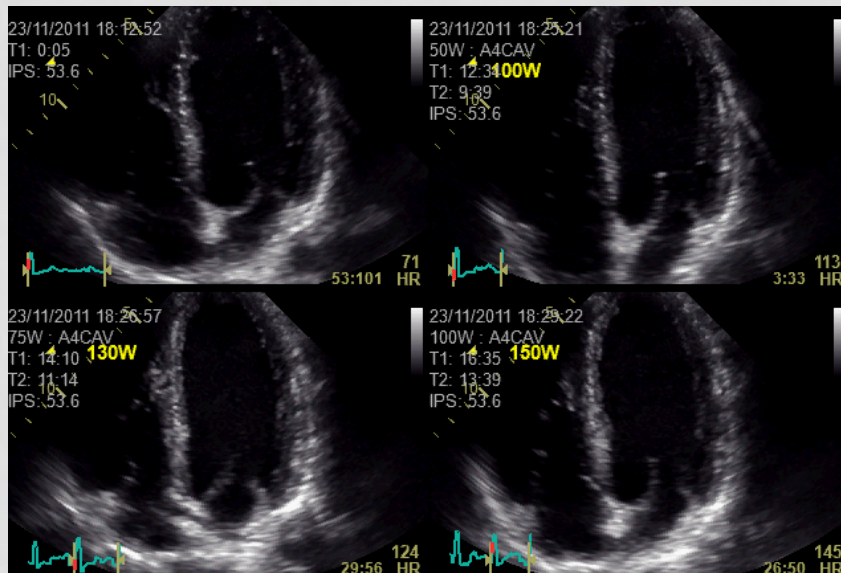


Abernethy, JACC 2003

Cœur d'athlète et Echo d'effort



156 foot pro

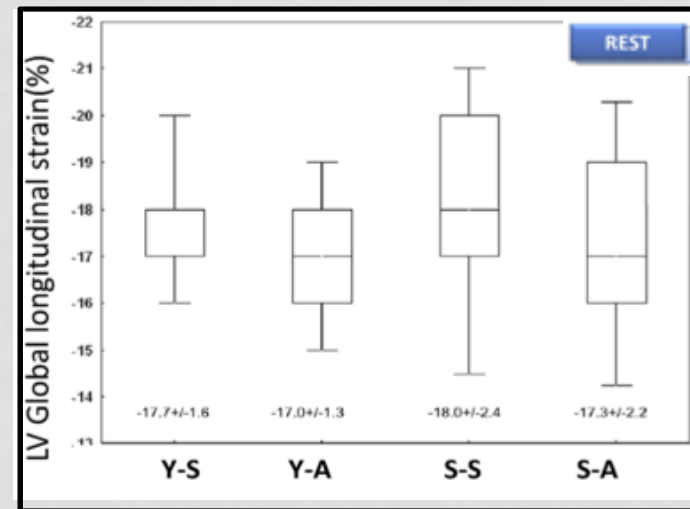


Adaptation normale
du VG à l'effort
FE VG à 76% (+/-14%).

Abernethy, JACC 2003

Cœur d'athlète et Echo d'effort

Parameters	Controls (n = 35) mean $\pm$ SD	ETA (n = 35) mean $\pm$ SD	STA (n = 35) mean $\pm$ SD	MTA (n = 35) mean $\pm$ SD	P-value
REPOS					
3D-LVEDV (mL)	126 $\pm$ 21	193 $\pm$ 26	154 $\pm$ 23	179 $\pm$ 27	<0.005*, 0.03 [†]
3D-LVEDVI (mL/m ²)	64 $\pm$ 14	103 $\pm$ 11	82 $\pm$ 13	95 $\pm$ 10	<0.005*, 0.01 [†]
3D-LVEF	63 $\pm$ 7	64 $\pm$ 6	64 $\pm$ 5	65 $\pm$ 7	NS
LVM (g)	124 $\pm$ 25	178 $\pm$ 30	149 $\pm$ 22	167 $\pm$ 28	0.03*, 0.05 [†]
LVMi (g/m ²)	69 $\pm$ 17	107 $\pm$ 15	93 $\pm$ 11	104 $\pm$ 12	0.02*, 0.05 [†]
TDI					
MV E _a (cm/s)	122 $\pm$ 2.3	20.3 $\pm$ 4.2	14.7 $\pm$ 2.6	18.8 $\pm$ 4.4	0.01*, 0.04 [†]
MV E/E _a	5.5 $\pm$ 1.4	2.7 $\pm$ 0.9	2.4 $\pm$ 0.7	2.3 $\pm$ 0.8	0.04*, 0.03 [†]
STI					
Global LS (%)	-20.3 $\pm$ 2.6	-21.7 $\pm$ 2.6	-22.5 $\pm$ 2.4	-21.6 $\pm$ 2.2	<0.05*



Vitarelli EHJ CI 2013

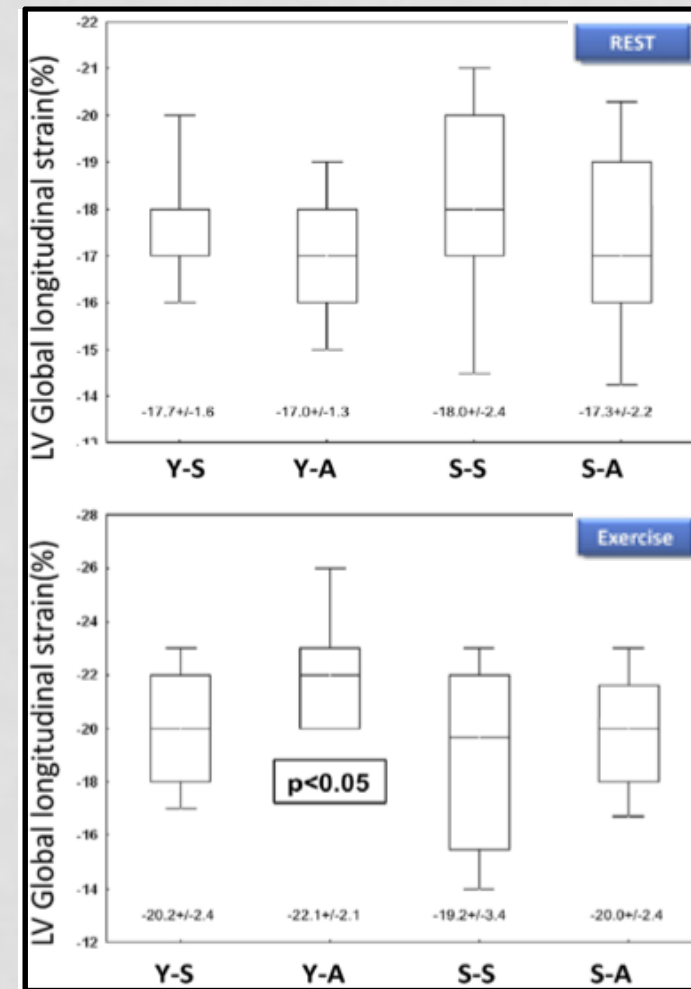
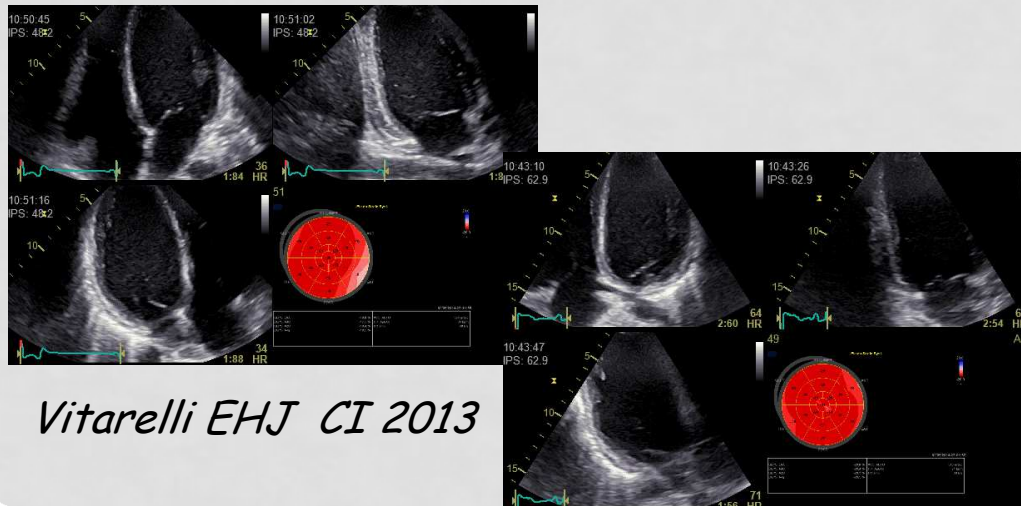
Donal. AJC 2011

Cœur d'athlète et Echo d'effort

Parameters	Controls (n = 35) mean ± SD	ETA (n = 35) mean ± SD	STA (n = 35) mean ± SD	MTA (n = 35) mean ± SD	P-value
REPOS					
3D-LVEDV (mL)	126 ± 21	193 ± 26	154 ± 23	179 ± 27	<0.005*, 0.03†
3D-LVEDVI (mL/m ²)	64 ± 14	103 ± 11	82 ± 13	95 ± 10	<0.005*, 0.01†
3D-LVEF	63 ± 7	64 ± 6	64 ± 5	65 ± 7	NS
LVM (g)	124 ± 25	178 ± 30	149 ± 22	167 ± 28	0.03*, 0.05†
LVMi (g/m ²)	69 ± 17	107 ± 15	93 ± 11	104 ± 12	0.02*, 0.05†
TDI					
MV E _a (cm/s)	122 ± 23	203 ± 42	147 ± 26	188 ± 44	0.01*, 0.04†
MV E/E _a	5.5 ± 1.4	2.7 ± 0.9	2.4 ± 0.7	2.3 ± 0.8	0.04*, 0.03†
STI					
Global LS (%)	-20.3 ± 2.6	-21.7 ± 2.6	-22.5 ± 2.4	-21.6 ± 2.2	<0.05*

EFFORT

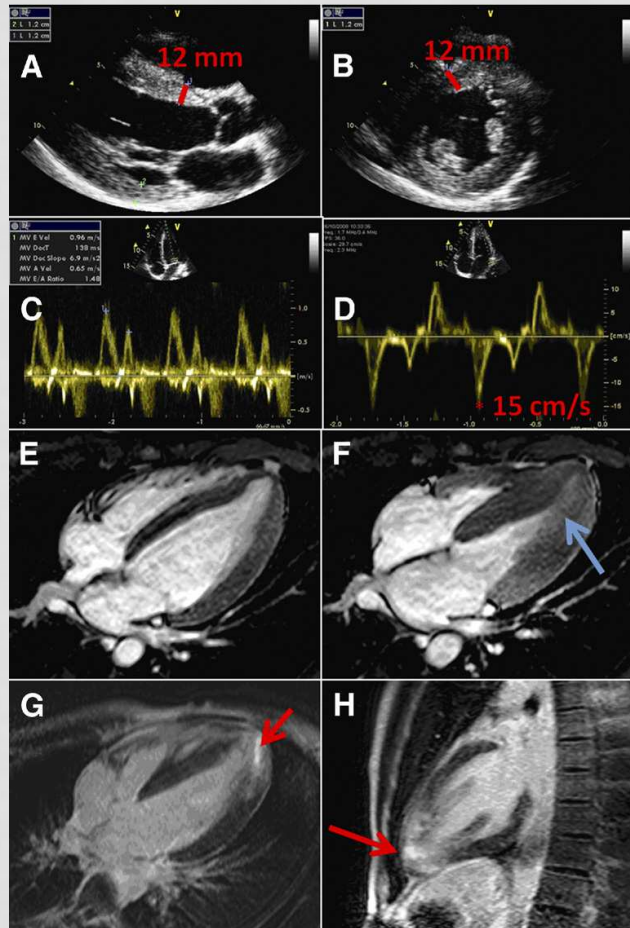
3D-LVEF	68 ± 8	67 ± 5	67 ± 9	66 ± 4	NS
LV Global LS (%)	-24.2 ± 3.3	-25.1 ± 2.7	-26.5 ± 2.4	-24.9 ± 2.5	NS



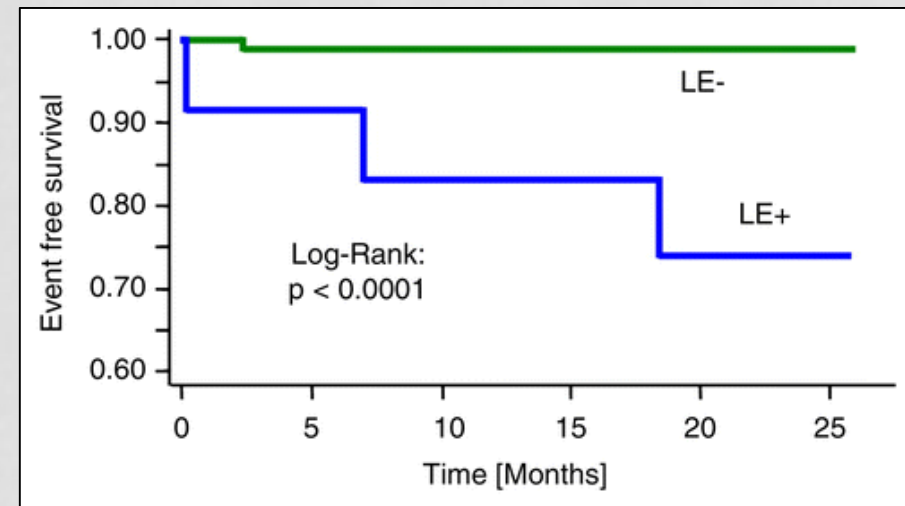
Donal. AJC 2011

Athlète et IRM

CMH, CMI, CMD,
Myocardite,



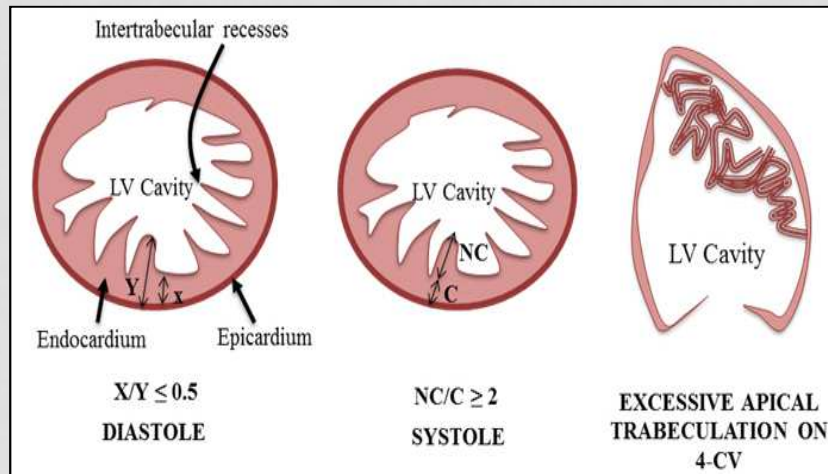
102 marathonien
(50-72a, FU 21m)
RT Mar/Tém
= 12 / 4%



Breuckmann et Al. Radiology 2009

La Gerche JACC ci 2009

ZG: Athlète et Non Compaction VG



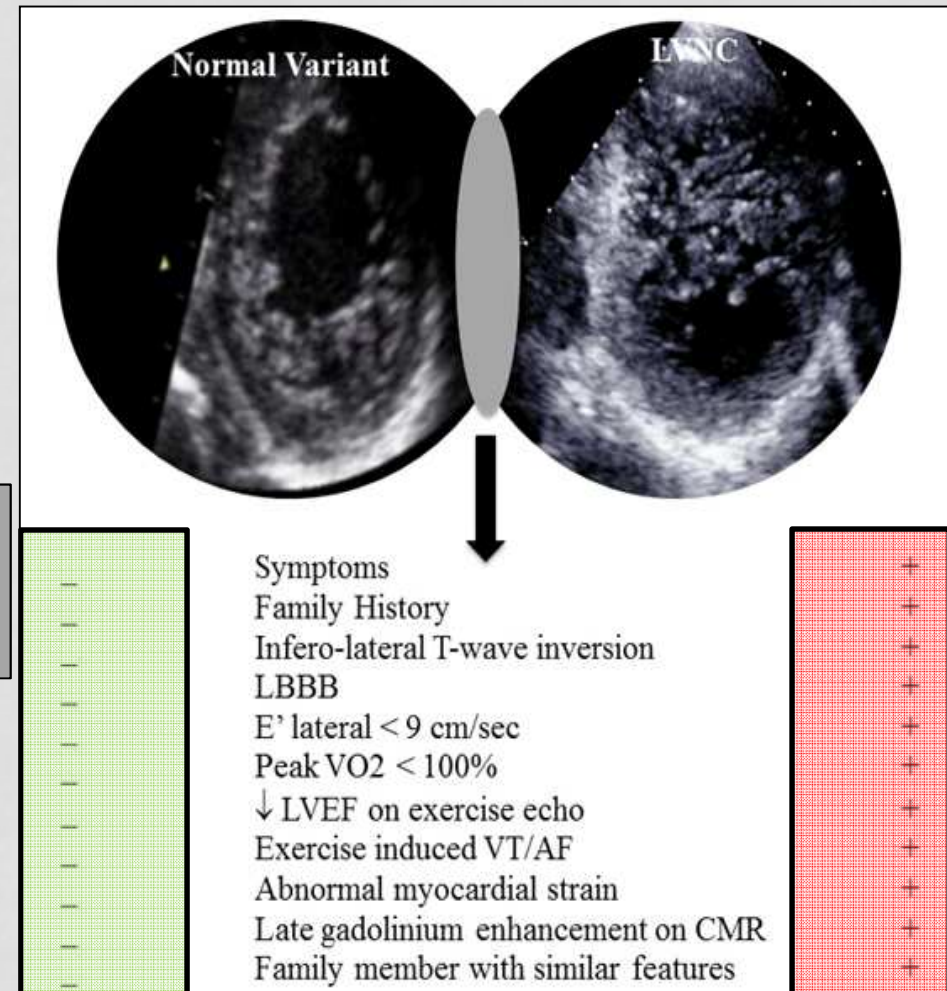
18% avec trabéculations +++
8% critères stt afro-caribéens
<1% avec tb ECG et FE VG ➡

Localisation des trabéculations

Apicolatérale ds NC VG
et Inféro-septale chez l'athlète

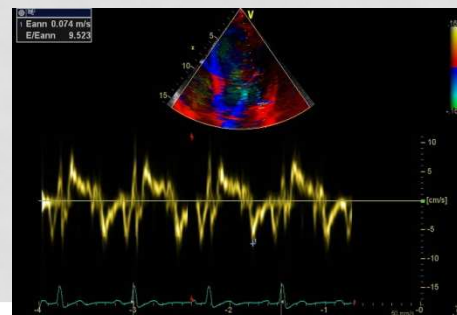
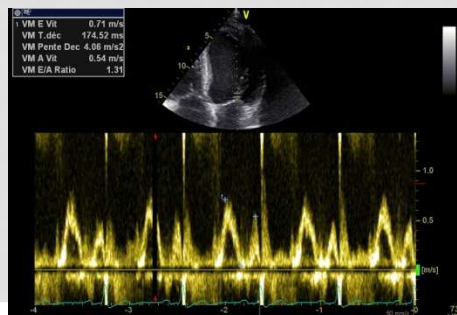
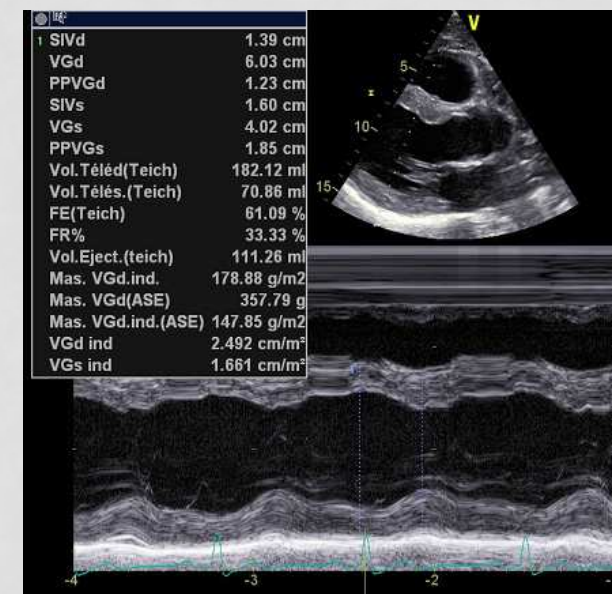
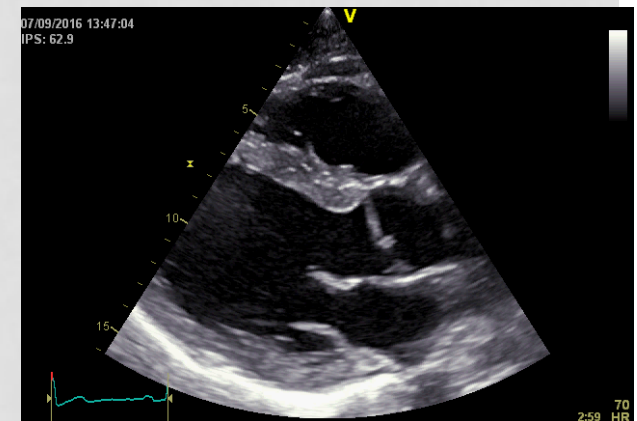
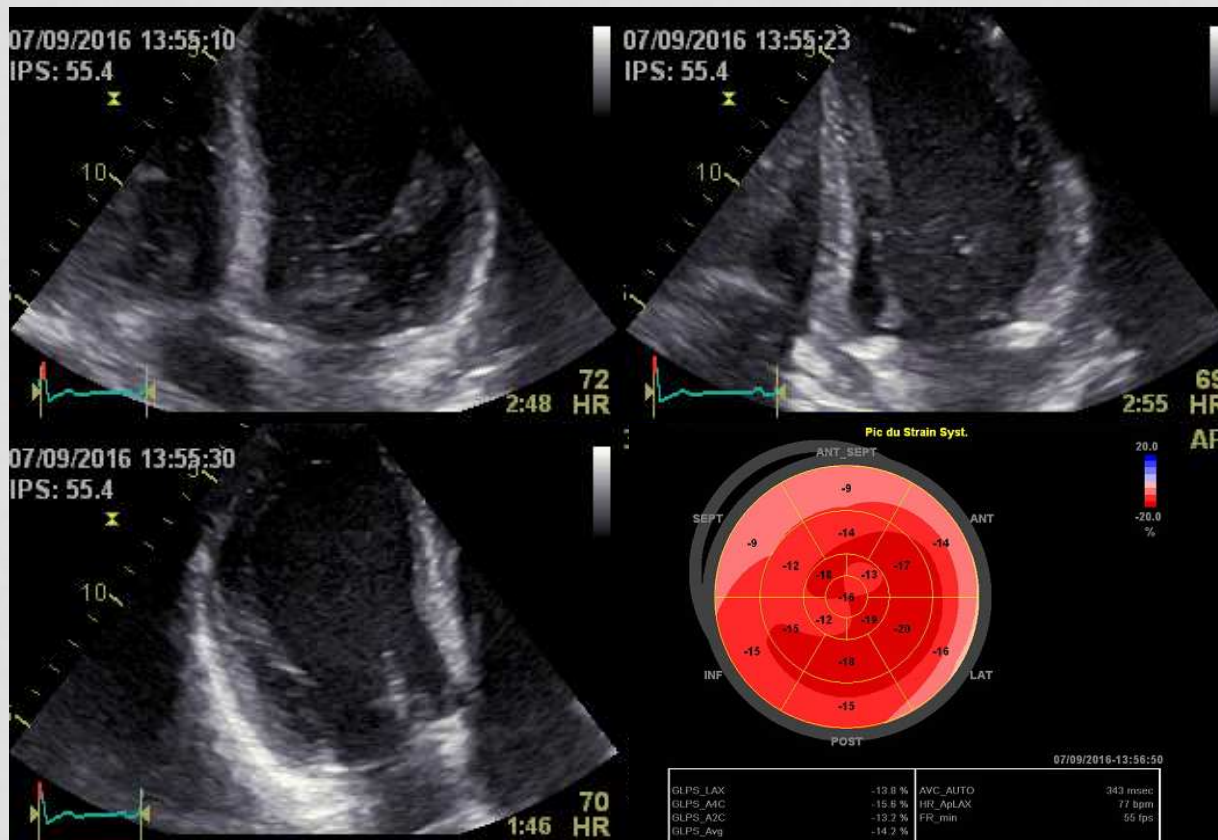
Gati S Heart 2013

1146 athlètes (14-35 ans) vs 415 T



Sharma review 2015

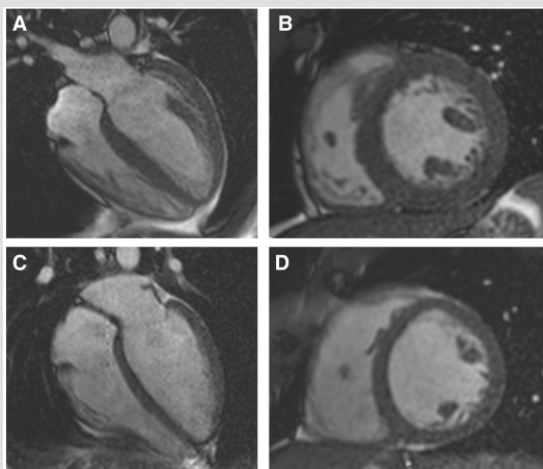
ET ATTENTION ...



COEUR ET DOPAGE = effets cardiaques des drogues améliorants la performance

Substance	HTN	Arrhythmias	LVH	CAD	MI	HF	SCD
Anabolic androgens	+	+	+	+	+	+	+
Human chorionic gonadotrophin		+	+			+	+
Erythropoietin	+					+	
B2 agonists		+			+	+	+
Diuretics		+					
Amphetamines	+	+			+	+	+
Cocaine	+	+		+	+	+	+
Ephedrine	+	+		+	+		+
Narcotics							+
Cannabinoids		+			+		+
Glucocorticoids	+			+			
Alcohol	+	+			+	+	+

Deligiannis et Al. ESC study group of sports cardiology.
EJCPR 2006;13:687-694.



AAS-using

LV/RV EF = 46/43%

strength athletes

non-AAS-using

LV/RV EF = 56/52%



Luijkx et Al. Int J Cardiol
2015;167:664-668

Le VG de l'ATHLÈTE

Normal

*pê dilaté
Épais +/- ---
FE Limite possible*

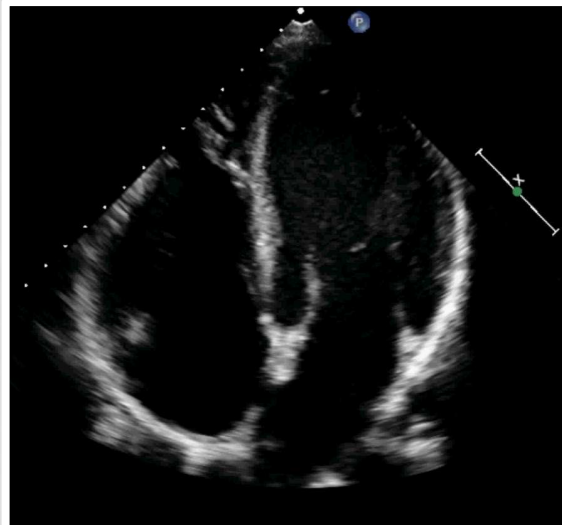
*Niveau
d'entraînement*

*Type
de sport*

*Niveau
de performance*

*Origine
ethnique*

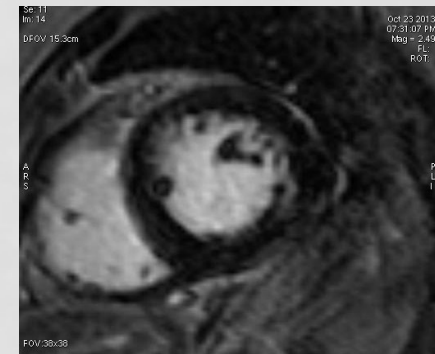
*Sexe,
Age, SC*



Génétique

Dopage

**COEUR D'ATHLÈTE
OU PATHOLOGIE?**



Suspicion CMH ou CMD

