Medical and Research Publications
International Open Access

Research Article **Journal of MAR Cardiology (Volume 4 Issue 3)**

Risk factors for LVEF alteration linked to apical stimulation: Monocentric retrospective study

Dr M Belhameche*, Dr N Zarouf[1], Dr S Sioua[2], Dr S Naccache[3], Dr A Salhi[4], Dr A Kovalchuk[5], Dr An Chaib[6], Dr H Bouzelmat[7]

1,2,3,4,5. GHEF Marne le vallée Rhythmology Unit.

6,7. Military hospital mohamed V Rabat.

Corresponding Author: Dr M Belhameche, GHEF Marne le vallée Rhythmology Unit.

Received Date: March 25, 2022

Published Date: April 01, 2022

Abstract

Background: *The aim of our retrospective study is to see what are the risk factors that can induce an alteration of left ventricular function (LVEF) in patients implanted with a Pacemaker with apical stimulation for conduction disorder.*

Method: *We implanted 520 patients between January 2019 and December 2020. We carried out the follow-up of 172 patients with an LVEF greater than 45%. The average follow-up is 18 months by echocardiography at 6, 12 and 18 months. We observed an alteration of LVEF in 43 patients, and compared these patients to the other 129 patients to see if there are any risk factors that may induce an alteration in LVEF.*

Results*43 patients altered their LVEF during follow-up, representing 8.7% of the population of 520.*

The mean time to onset of LVEF impairment was 6 months, sometimes with signs of heart failure requiring hospitalization. We ruled out any other pathology at the origin of this alteration in contractile function.The identified risk factors are: -Age, Ischemic cardiomyopathy, LVEF, Percent of pacing, Kidney failure

Key Words. Apical pacing (AP), risks factors (RF), Left ventricular fraction ejection (LVEF), Arhythmic cardiomyopathy (AC), Pacemaker (PM) , Upgrade pacing, Non upgrade pacing.

Concept of Asynchronism

- We know that there are arhythmic heart disease.
- And we know from Cazeau's study the deleterious and aggravating effect of the existence of a left bundle branch block or of the apical stimulation.
- We will conclude that the apical RV pacing can lead to arhythmic heart disease.

Method

Retrospective study.

- We have implanted 520 patients by Pacemaker (PM) between January 2019 and December 2020.
- We screened 172 patients who had a cardiac ultrasound before PM implantation at 6,12, and 18 months
- We observe that they have 43 out of 520 (8,2%) patients who required an Up-grading PM due to the alteration of their left ventricular function (LVFE) with heart failure chart.
- We tried to find out if there are risk factors that facilitate the alteration of LVEF.

Study population

Followed-up of 172 patients for 2 years Average follow-ups is 18 months

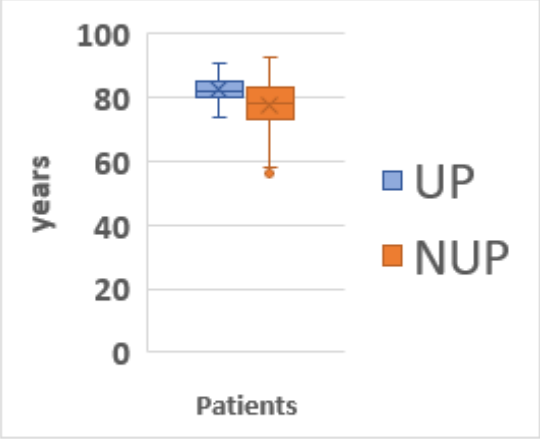
Number.	520 patients (172p)
Age	60 to 88 years
Sex	75 % are man.
Cardiomyopathy	81 %
LVEF.	45 to 65 %.
Hypertension	78%
Diabetes	50%
Renal insufficiency (creatinine clearance lower than 40 ml)	53%
Dysthyroid	23%

Arrhythmia (atrial fibrillation)	76%
Chronic bronchitis.	38%
Sleep apnea syndrome.	35%
Percent RV pacing.	48%
Medical treatment. (Ri or Ai,betablocker)	80%

The risk factors that have appeared are:

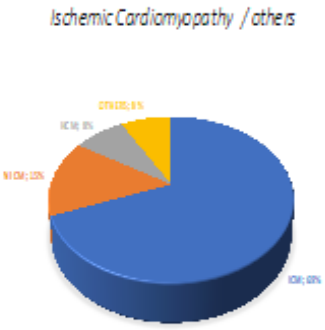
Patients Up-grading. (43p)	Patients without up-grade.(129p)
Age 83 years.	78 years.
Ischemic CM 69%.	30%.
Atrial fibrillation 81%.	78%.
Percent of pacing >88 %.	< 40%
LVEF < 55%.	> 55%
Sex 85 % was man.	ND
Kidney failure (< 40ml) > 75%.	< 45%

AGE in years.



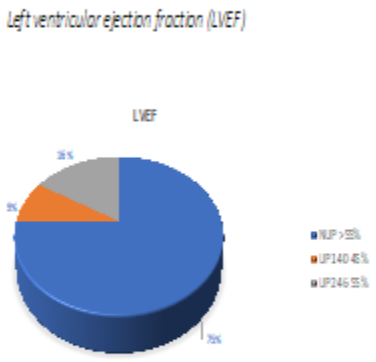
For the oldest age most of the population were men

Cardiomyopathy



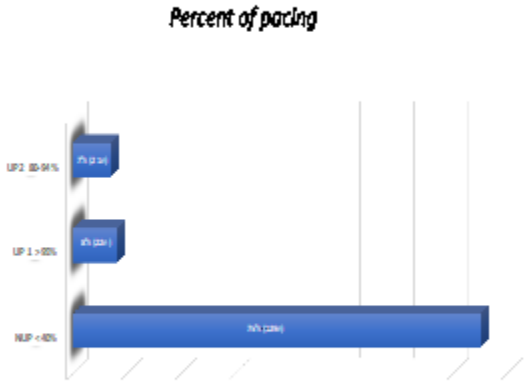
69% of patients had ischemic cardiomyopathy

L V F E.



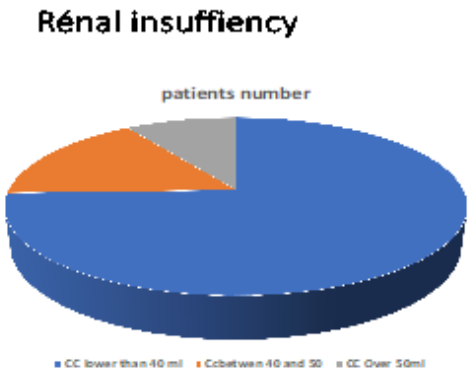
The cut off of NUP LVEF was 55%

% Of Pacing.



The cut off of NUP of % of pacing was 40%

Renal insuffiency



Renal failure was defined as creatine clearance below 40ml . 53 % of patients had a UPG had a clearance less than 40ML

Discussion

- We have identified 5 risk factors for alteration of LVEF:
- Age
- Ischemic cardiomyopathy
- Left ventricular ejection fraction.
- Percent pacing.
- Renal failure.

Study limitations

- Reviews:
- Single-center retrospective study.
- Implantation of 520 but followed by 172. And 43 patients who required Up-grade this following 8,2%.
- Medical treatment is not the same because of a population is very different.

Arrhythmic cardiomyopathy (1,2,3,4,5,6)

Arythmic cardomyopathie

- They are not known. The diagnosis is often exclusionaty which distubances of rythm or conduction .
- They classified :
  - As pure CMR because we dont found an cardiopathie.
  - As impure CMR and in fact aggravate an existing heart disease.

The RV pacing can inducting an arythmic cardiomyopathie or aggravate en existing heart disease.

Physiopathology (4,5,6,7,8,9)

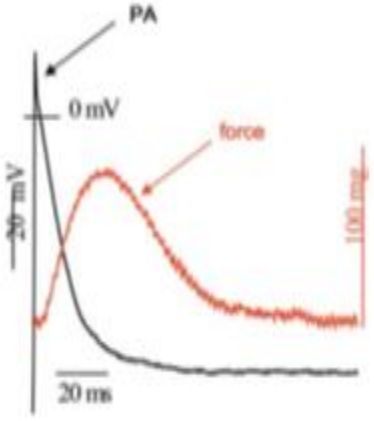
Pathophysiology

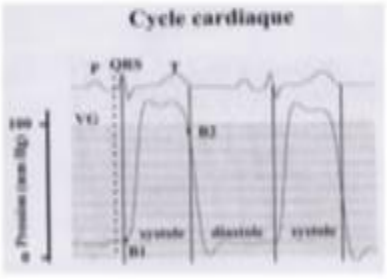
- The apicale pacing causes a desynchronization with a widening of the QRS resembling the left bundle branch block whose deleterious effects on myocardial contractility are Know.
- This asynchronism leads to ventricular remodeling. The consequences of which include an overlap in systole diastole, mitral insufficiency and a decrease in contractility, therefore dilation of the LV and decrease in LVEF.
- MOST and DAVID study demonstrated the deleterious effect of RV stimulation .

Pathophysiology

- Right ventricular pacing affects myocardial perfusion.
- Right ventricular pacing reducedd inferior,septal and global blood flow (Nilsen , Ono S)
- LEE found in 16 dogs with iatrogenique AV bloc that the cardiac tissu noepinephrine level was significantly hight

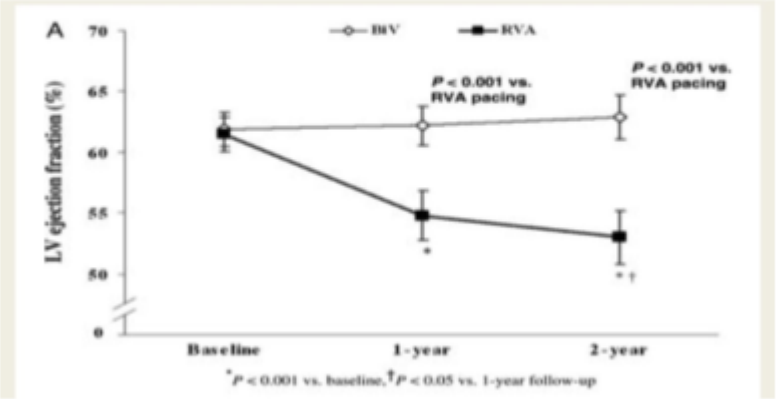
(11,12,13,14,15,16,17)



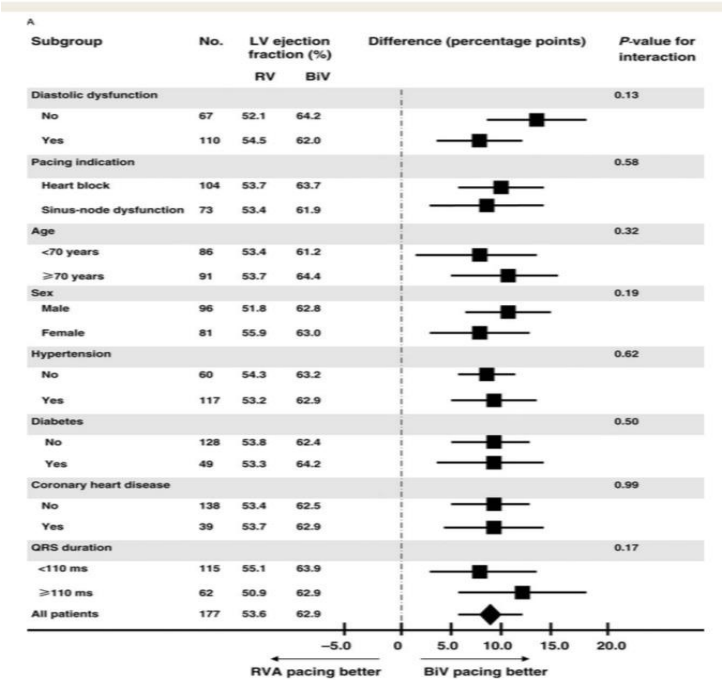


1,2,18,19,20,21

PACE study (Deleterious effect of RV pacing on the LVEF)

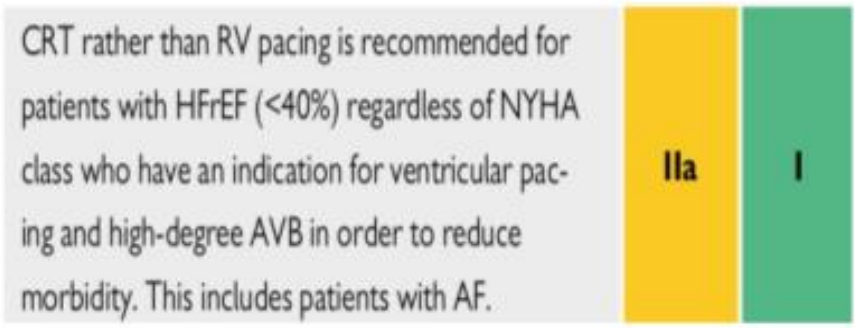


PACE study (beneficial effect of biventricular pacing on RV pacing)



(22,23,24,25,26,27,28,29)

ESC recommandations



Discussion

the interest of this study, even if it is monocentric and retrospective, is to show the risk factors that can contribute to the evolution towards a rhythmic heart disease in the event of apical stimulation by a pacemaker.

Numerous studies have shown the deleterious effect of apical stimulation but have not specified the risk factors towards this development.

Neither do the ESC recommendations. They recommend with a level IIa for a CRT only in case of LVEF < 40% and a rate of RV stimulation > 20% (this would be related to the CMRs induced by an ESV rate > 20%).

I think it is important that there are other larger and prospective studies to further clarify the factors likely to favor the evolution towards CMR.

Conclusion

The interest of this work is to have highlighted certain factors such as age, ischemic CM, LVEF, RV stimulation rate and renal failure. This avoids taking a patient for an Up grading

References

1/ Mbelhameche PHD,MD Arrhythmic cardiomyopathy MARcardilogy febriary 2022

2.Whipple GH, Sheffield LT, Woodman EG. Reversible congestive heart failure due to chronic rapid stimulation of the normal heart. Pro N Engl Cardiovasc Soc 1962; 20:39-40.

3. V. Ramesh Iyer, MD. Ventricular Dysfunction: Tachycardia induced Cardiomyopathy. Indian Pacing and Electrophysiology Journal 2008 : Suppl. 1: S122-S129

4. Mark E. Josephson. Clinical cardiac electrophysiology. 3th ed. Philadelphia (PA): Lippincott Williams & Williams; 2002

5 Ernesto Umana, MD, C. Arturo Solares, MD, Martin A. Alpert, MD. Tachycardia-Induced Cardiomyopathy. Am J Med. 2003; 114:51–55.

6. Quiniou G, Chevalier JM, Barbou F, Bire F, Clementy J. Tachycardia-induced cardiomyopathy, unusual and

7. Chugh SS, Havmoeller R, Narayanan K, et al. Worldwide epidemiology of atrial fibrillation: a Global Burden of Disease 2010 Study. Circulation 2014;129:837–47.

8. Attule Pathakl :La cardiopathie rythmique: mythe ou réalites Réalités Cardiologiques – n° 342_Janvier 2019

9.Joseph Yat-Sun Chan PACE trial European Heart Journal (2011) 32, 2533–2540doi:10.1093/eurheartj/ehr336

10. Tse HF, Yu C, Wong KK, Tsang V, Leung YL, Ho WY, Lau CP. Functional abnorm- alities in patients with permanent right ventricular pacing: the effect of sites of electrical stimulation. J Am Coll Cardiol 2002;40:1451 – 1458.

11. O'Keefe JH Jr, Abuissa H, Jones PG, Thompson RC, Bateman TM, McGhie AI, Ramza BM, Steinhaus DM. Effect of chronic right ventricular apical pacing on left ventricular function. Am J Cardiol 2005;95:771–773.

12. Fang F, Zhang Q, Chan JY, Xie JM, Fung JW, Yip GW, Lam YY, Chan A, Yu CM. Deleterious effect of right ventricular apical pacing on left ventricular diastolic function and the impact of pre-existing diastolic disease. Eur Heart J 2011;32: 1891 – 1899.

13. Prinzen FW, Hunter WC, Wyman BT, McVeigh ER. Mapping of regional myocar- dial strain and work during ventricular pacing: experimental study using magnetic resonance imaging tagging. J Am Coll Cardiol 1999;33:1735–1742.

14. Nielsen JC, Bøttcher M, Nielsen TT, Pedersen AK, w Andersen HR. Regional myo- cardial blood flow in patients with sick sinus syndrome randomized to long- term single chamber atrial or dual chamber pacing—effect of pacing mode and rate. J Am Coll Cardiol 2000;35:1453–1461.

15. Prinzen FW, Cheriex EC, Delhaas T, van Oosterhout MF, Arts T, Wellens HJ, Reneman RS. Asymmetric thickness of the left ventricular wall resulting from asynchronous electric activation: a study in dogs with ventricular pacing and in patients with left bundle branch block. Am Heart J 1995;130:1045–1053. 22/Nahlawi M, Waligora M, Spies SM, 22/Bonow RO, Kadish AH, Goldberger JJ. Left ventricular function during and after right ventricular pacing. J Am Coll Cardiol 2004;44:1883 – 1888.

16. Hayes JJ, Sharma AD, Love JC, Herre JM, Leonen AO, Kudenchuk PJ; DAVID Investigators. Abnormal conduction increases risk of adverse outcomes from right ventricular pacing. J Am Coll Cardiol 2006;48:1628 – 1633.

17. Fang F, Chan JY, Yip GW, Xie JM, Zhang Q, Fung JW, Lam YY, Yu CM. Prevalence and determinants of left ventricular systolic dyssynchrony in patients with normal ejection fraction received right ventricular apical pacing: a real-time three- dimensional echocardiographic study. Eur J Echocardiogr 2010;11:109–118.

18. Sanders P, Morton JB, Davidson NC, et al. Electrical remodeling of the atria in congestive heart failure: electrophysiological and electro- anatomic mapping in humans. Circulation 2003; 108:1461–8.

19. Ives DG, Fitzpatrick AL, Bild DE, et al. Surveillance and ascertainment of cardiovascular events. The Cardiovascular Health Study. Ann Epidemiol. 1995; 5:278–285. [Pub Med: 8520709]

20. Fenelon G, Wijns W, Andries E, et al. Tachycardiomyopathy: mechanisms and clinical implications. Pacing Clin Electrophysiol. 1996; 19:95–106. [PubMed: 8848384]

21. Fenelon G, Wijns W, Andries E, et al. Tachycardiomyopathy: mechanisms and clinical implications. Pacing Clin Electrophysiol 1996;19:95–106.

22. Nielsen JC, Pedersen AK, Mortensen PT, Andersen HR. Programming a fixed long atrioventricular delay is not effective in preventing ventricular pacing in patients with sick sinus syndrome. Europace 1999;1:113–120.

23. Ishikawa T, Kimura K, Miyazaki N, Tochikubo O, Usui T, Kashiwagi M, Ishii M. Diastolic mitral regurgitation in patients with first-degree atrioventricular block. Pacing Clin Electrophysiol 1992;15:1927–1931.

24. Martin CA, Lambiase PD. Pathophysiology, diagnosis, and treatment of tachycardiomyopathy. Heart 2017; 103:1543-52.PUBMED | .

25. Ryu K, Cho M, Choi D, et al. Recovery pattern and term of reversal of left ventricular remodeling in patients with congestive heart failure. Eur J Heart Fail Suppl 2006;5:146.C .

26. Brignole m, gianfranchi l, menozzi c, et al. influence of atrioventricular junction radiofrequency ablation in patients with chronic atrial fibrillation and flutter on quality of life and cardiac performance. am j cardiol 1994; 74:242–6.

27.Heinz g, siostrzonek p, kreiner g, et al. improvement in left ventricular systolic function after successful radiofrequency his bundle ablation for drug refractory, chronic atrial fibrillation.

28. Guidelines ESC/AHA 2021.