Which Heart Failure patients will improve their exercise capacity after exercise training ?

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No conflict of interest

Completion of an exercise training program (ETP)

- Probably improves outcome[1]

- Improves exercise capacity of about 15-20% (peak VO2) in numerous clinical studies
  - But some patients are « un-responsive » : their peak VO2 does not improve after completion of an ETP

1°) ExTraMATCH Study. BMJ 2004;328(7433):189.

Questions

- 1°) What is the reason why some patients do not improve their exercise capacity after an ETP completion ?
  - Beyond the scope of our study

- 2°) Is the prognosis of un-responsive patients different of the prognosis of responsive ones ?
  - Dr Tabet Wednesday morning ; 11.00 room Stockholm

- 3°) For a given patient, can we predict if he will benefit from exercise training or not ?
  - Is the question we will try to answer to In order to determine if cardiac rehabilitation could be :
    - –Strongly recommended to some groups of patients
    - –Refused to others

Methods

- French Prospective bi-centric study :
  - Les Grands Prés (Cardiac Rehabilitation Center)
  - Lariboisière Hospital
- Patients :all non valvular CHF patients referred for cardiac rehabilitation and :
  - stable (1month)
  - Able to perform an ETP
  - Receiving a beta-blocker therapy

Does baseline parameters predict VO2 improvement after the ETP completion ?

- Clinical parameters :
  - Age, gender, BMI, NYHA class, cause of the heart failure, diabetes, atrial fibrillation, left bundle block, triple chamber pacing, beta-blocker doses, number of exercise training sessions
- Echographic parameters :
  - LVEF, LVEDD,SPA, E deceleration time, E/A, E/Ea.
- Biological parameters :
  - BNP, Haemoglobinemia, creatininemia.
- Ergometric parameters :
  - Peak VO2, AT, Max SBP, HR at rest and at peak exercise, 1 min HR recovery.

Results

Baseline Patients Characteristics (whole population)

- 144 stable CHF patients :
  - Age : 53.4 ± 12.3
  - Sex : male 82 %
  - CHF aetiology :
    - Ischaemic : 56 %
  - Sinusal rythm : 91 %; Heart rate : 74.3 ± 13.8
  - LVEF : 29.7 ± 6.8 %
  - PVO2 : 16.2 ± 4.4 ml/kg/mn
  - BNP : 462 ± 346 pg/ml
  - Treatment
    - Beta-blocker : bisoprolol n = 122 (3.7 ± 2.4 mg), carvedilol, n = 22 (22 ± 21 mg)
    - ACE : 98 %, amiodarone : 22%, aldactone : 53%

Exercise training program :

- Exercise training sessions (19 ± 9 per patient) :
  - 3 to 5 per week
  - Bicycle training sessions :
    - 5 min warm up
    - 30 min at 60% of PVO2
    - 5 min cool down
  - Segmental gymnastics :
    - 30 min

Exercise capacity improvement after the ETP

- Peak VO2 improvement :
  - Mean :+ 15% : + 2.3 $\pm$ 2 ml/Kg/mn ($p < 0.0001$)
  - Median : + 2 ml/kg/min
- Population divided in 2 goups :
  - Responsive patients,n = 72 :
    - PVO2I > 2 ml/kg/min (3.9 $\pm$ 2.3)
  - Un-responsive patients, n = 72
    - PVO2I $\leq$ 2 ml/kg/min (0.3 $\pm$ 1.3)

Comparison of responsive and un-responsive patients

Can the baseline characteristicts predict which patient will benefit from exercise training ?

Baseline clinical parameters

	Un-responsive	Responsive	p
Age	54.7 ± 12.5	52.3 ± 12.1	0.2
Male Sex	80 %	84 %	0.3
BMI	26 ± 4	25 ± 5	0.1
NYHA	2.4 ± 0.6	2.45 ± 0.6	0.7
Diabetes	24 %	17 %	0.4
Rest HR (bpm)	75 ± 17	74 ± 13	0.6
Sinusal rythm	88 %	96 %	0.13
Ischaemic CHF	62 %	48 %	0.12
Bisoprolol (n = 120) Carvedilol (n = 24)	3.7 ± 2.7 mg 26 ± 23 mg	3.6 ± 2.3 mg 19 ± 17 mg	0.8 0.4

Baseline echographic parameters

	Un-responsive	Responsive	p
LVEF	29 ± 7%	30 ± 6%	0.3
LVEDD (mm)	63 ± 8	63 ± 7	0.9
E/A ratio	1.4 ± 0.9	1.4 ± 0.9	0.98
E/Ea ratio	11 ± 4	10 ± 4	0.4
SPAP (mmHg)	34 ± 10	35 ± 8	0.6
E deceleration time	171 ± 15 ms	180 ± 82 ms	0.35

Baseline ergometric parameters

	Un-responsive	Responsive	p
Rest HR (bpm)	75 ± 17	74 ± 13	0.6
Max HR	120 ± 21	121 ± 25	0.6
HR recovery 1 min	12 ± 14	14 ± 11	0.5
Max SBP (mmHg)	135 ± 20	137 ± 25	0.5
Peak VO2 (ml/kg/mn)	15.8 ± 3.7	16.7 ± 4.8	0.2
AT	11.7 ± 3.1	12.4 ± 3.4	0.12
VE/VCO2 slope	37 ± 8	34 ± 7	0.15

Baseline biological parameters

	Un-responsive	Responsive	p
Haemoglobinemia (g/dl)	12.8 v 1.6	13.1 ± 1.5	0.25
Creatininemia (mmol/l)	108 ± 33	104 ± 27	0.6
BNP (pg/ml)	415 ± 493	472 ± 350	0.8

Do some specific groups of patients benefit more (or less) from an ETP ?

Specific Groups

- Elderly ? P = 0.22
  - < 60 y : PVO2I = 16 ± 16%
  - > 60 : PVO2I 12 ± 19 %
- Women ? P = 0.8
  - men : PVO2I = 2.2 ± 2.8
  - women : PVO2I = 2.4 ± 3.3
- Ischaemic cardiomyopathy ? P = 0.4
  - isch : PVO2I = 2.1 ± 2.6
  - Non isch : PVO2I = 2.5 ± 2.8

Specific Groups

- Unfit patients ? P = 0.27
  - Baseline PVO2 < 16 : PVO2I = 2.2 ± 2.1
  - Baseline PVO2 > 16 : PVO2I = 2.5± 3.2
- Anaemic patients ? P = 0.8
  - Baseline Hb < 13 : PVO2I = 2.2 ± 2.4
  - Baseline Hb > 13 : PVO2I = 2.1± 2.8

Number of exercise training sessions

	Un-responsive	Responsive	p
Number of sessions	18 ± 10	23 ± 12	0.05

< 20 sessions; PVO2I = 1.6 ± 2.3
> 20 sessions; PVOI = 2.9 ± 2.8

} P = 0.01

Conclusion

- In beta-blocked heart failure patients :
  - 1°) cardiac rehabilitation does improve exercise capacity (PVO2 and AT)
  - 2°) For a given patient, it is impossible to predict if he will – or not- improve his exercise capacity after completion of an ETP
- Therefore,
  - All CHF patients should attend Cardiac Rehabilitation