TCTAP 2023

Neurocognitive Trajectory Following TAVR

Mao-Shin Lin, MD, PhD
Cardiovascular Center
Division of Cardiology, Department of Internal Medicine
National Taiwan University Hospital

Disclosure

Speaker's name : Mao-Shin Lin

☑ I do not have any potential conflict of interest to declare

Neurocogntive Function and Cardiac Surgery

- Neurological injury is a common complication after cardiac surgery that may contribute to cognitive decline
- Impact on patients' quality of life, recovery from surgery, participation in rehabilitation and long-term mortality
- Involves a number of mechanisms including cerebral hypoperfusion and oxygenation, microemboli causing silent brain infarcts or a systemic inflammatory response

ACC/AHA CLINICAL PRACTICE GUIDELINE

2020 ACC/AHA Guideline for the Management of Patients With Valvular Heart Disease: Executive Summary

A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

COR	LOE	Recommendations
		1. For symptomatic and asymptomatic patients
1	A	TAVI, either SAVR or transfemoral TAVI is recommended after shared decision-making about the balance between expected patient longevity and valve durability.[123,126–130]
1	A	3. For symptomatic patients with severe AS who are >80 years of age or for younger patients with a life expectancy <10 years and no anatomic contraindication to transfemoral TAVI, transfemoral TAVI is recommended in preference to SAVR.[123,126–132]

What is the effect of TAVR on neurocognitive function ?

The Importance of Neurocognitive Function in TAVR

- Patients with aortic stenosis always have a high comorbidity burden, and associated with greater risk of postoperative cognitive decline
- Predictive of functional decline, lack of mobility, poor quality of life, and mortality in elderly.
- The impact of microembolization on neurocognitive outcome following TAVR is not clear
- Issues of embolic protection devices

Neurocogntive Function in Patients with Severe Aortic Stenosis

- Low cardiac output due to severe cardiovascular disease associated with a faster rate of cognitive decline in the attention, executive, and psychomotor domains.

Heart. 2012 Sep;98(18):1334-40.

J Cardiopulm Rehabil Prev. 2011 Sep-Oct;31(5):290-7.

- Insufficient cardiac output seen in patients with severe AS may lead to cerebral hypoperfusion, and then contribute to cognitive decline.

Stroke. 2011 Nov;42(11):3323-8.

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EDITORIAL COMMENT

Can TAVR Make Me Smarter?*

Philippe Généreux, MD[a,b,c]

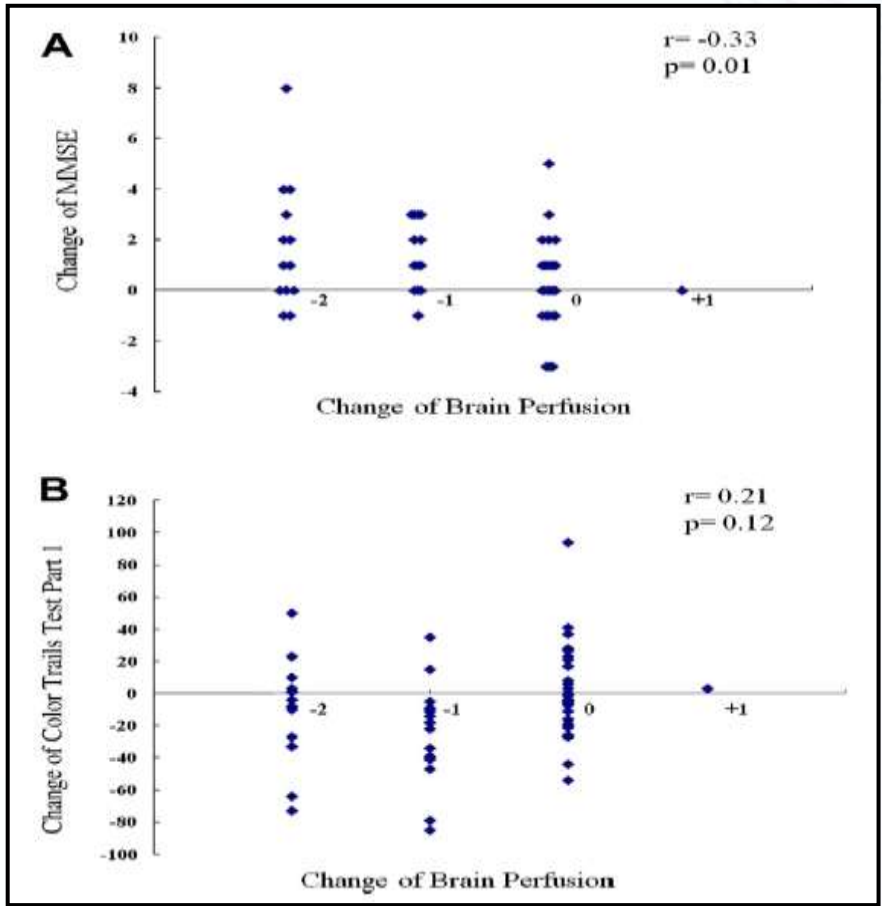
- Cognitive function is reversible
- Restoration of cerebral blood flow can lead to improved cognitive function

CLINICAL RESEARCH — Interventional Cardiology

Association of the Recovery of Objective Abnormal Cerebral Perfusion With Neurocognitive Improvement After Carotid Revascularization

Ching-Chang Huang, MD,* Ying-Hsien Chen, MD,* Mao-Shin Lin, MD,*† Cheng-Hsin Lin, MD,†‡ Hung-Yuan Li, MD, PHD,* Ming-Jang Chiu, MD, PHD,§‖ Chi-Chao Chao, MD,§ Yen-Wen Wu, MD, PHD,*¶#** Ya-Fang Chen, MD,†† Jen-Kuang Lee, MD,‡‡ Ming-Jiuh Wang, MD, PHD,§§ Ming-Fong Chen, MD, PHD,* Hsien-Li Kao, MD*

Taipei and New Taipei City, Taiwan

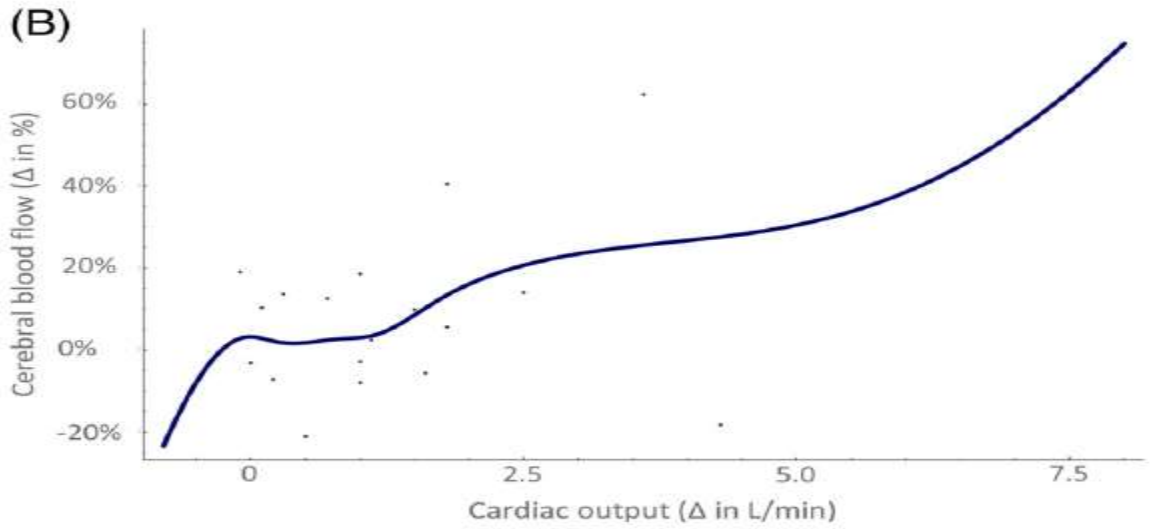


J Am Coll Cardiol 2013;61:2503–9

BRIEF REPORTS

Cerebral Blood Flow in Patients with Severe Aortic Valve Stenosis Undergoing Transcatheter Aortic Valve Implantation

Wieneke Vlastra, MD, PhD, Astrid C. van Nieuwkerk, MD,* Anne-Sophie G.T. Bronzwaer, PhD,†‡ Adriaan Versteeg, BSc,§ Esther E. Bron, PhD,§ Wiro J. Niessen, MD, PhD,§ Henk J.M.M. Mutsaerts, MD, PhD,¶ Björn J.P. van der Ster, MSc,†‡ Charles B.L.M. Majoie, MD, PhD,¶ Geert J. Biessels, MD, PhD,‖ Aart J. Nederveen, MD, PhD,¶ Mat J.A.P. Daemen, MD, PhD,** Matthias J.P. van Osch, PhD,†† Jan Baan, MD, PhD,* Jan J. Piek, MD, PhD,* Johannes J. Van Lieshout, MD, PhD,†‡‡‡ and Ronak Delewi, MD, PhD**



1. The increase in cerebral blood flow after TAVR related to the increase in cardiac output
2. An 8% increase in cerebral blood flow per every additional liter of cardiac output following the TAVR.

J Am Geriatr Soc. 2021;69(2):494-499.

The Effect of TAVR on Neurocognitive Function

- The effects of TAVR on cognitive outcome are diverse.
- Several confounding factors :

The composite effect of TAVR on neurocognitive function is still not clear

1. Short-term cerebral hypo-perfusion during balloon aortic valvuloplasty/valve deployment
2. Diffusion weighted magnetic resonance imaging (DWI) revealed new cerebral embolic lesions in up to 70% of patients after TAVR

Cognitive Outcomes After Transcatheter Aortic Valve Implantation: A Metaanalysis

Maisha M. Khan, BSc,† Nathan Herrmann, MD,*‡ Damien Gallagher, MD,‡ Dov Gandell, MD,§ Stephen E. Fremes, MD,¶ Harindra C. Wijeysundera, MD, PhD,¶ Sam Radhakrishnan, MD,¶ Yue Ran Sun, BSc,*† and Krista L. Lanctôt, PhD*†‡*

J Am Geriatr Soc 66:254–262, 2018.

Variable results in the effect of TAVR on neurocognititve outcome

Erica S. Ghezzi, BPsych(Hons)[a,*], Tyler J. Ross, BPsych(Hons)[a], Daniel Davis, PhD, MRCP[b], Peter J. Psaltis, MBBS (Hons), PhD, FRACP, FCSANZ[c,d,e], Tobias Loetscher, PhD[a], and Hannah A.D. Keage, PhD[a]

Am J Cardiol 2020;127:105–112

Serial Changes in Cognitive Function Following Transcatheter Aortic Valve Replacement

J Am Coll Cardiol 2016;68:2129–41

Why still remain controversy?

- Small sample size (mostly < 100 cases)
  - A larger cohort showing true longitudinal trajectory of post-TAVR cognition is mandatory
  - Comparison between low & intermediate-high risk group
- Heterogeneous population
- Variable sensitivity of cognitive tests in different population

NTUH
TAVR & Neurocognitive Function Study

- June 2015 to March 2020
- Successful TAVR patients underwent baseline, 3 month and 1 year evaluations
  - NIHSS
  - Barthel index

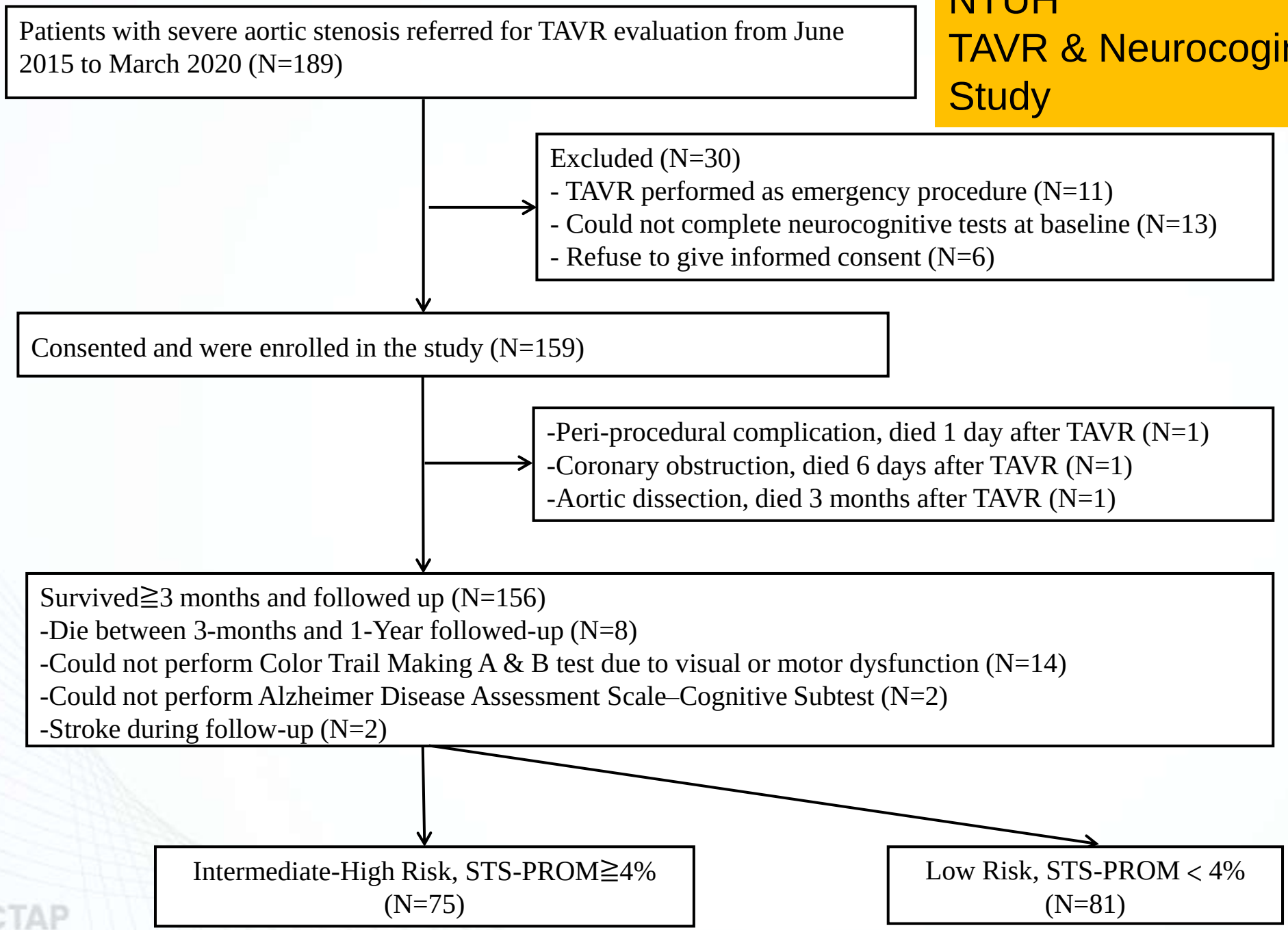
Neurologic assessments

  - Mini-Mental State Examination (MMSE)
  - Alzheimer's Disease Assessment Scale (ADAS) cognitive subset
  - Color trail test A
  - Color trail test B
  - Verbal fluency

High executive function assessments

Global cognitive assessments

NTUH
TAVR & Neurocogintive Function Study



Serial Changes of Neurological and Cognitive Assessments in Overall Cohort

	Baseline Evaluation N=156 A	3 Month Evaluation N=156 B	1 Year Evaluation N=148 C	A vs B P value	A vs C P value	B vs C P value
NIHSS						
Score	0 (0-0)	0 (0-0)	0 (0-0)	0.097	0.070	0.501
Number of score > 0	18 (11.5%)	12 (7.7%)	9 (6.1%)	0.286	0.057	0.581
Barthel index						
Score	100 (95-100)	100 (100-100)	100 (100-100)	0.019	0.0237	0.5504
Number of score < 100	40 (25.6%)	37 (23.7%)	28 (18.9%)	0.678	0.087	0.189
MMSE						
Score	27 (22-29)	28 (25-30)	29 (25-30)	0.0014	0.001	0.282
Number of score < 26	61 (39.1%)	49 (31.4%)	41 (27.7%)	0.029	0.0009	0.524
ADAS-cog	4 (1-10)	2 (1-6)	2 (0-5)	<0.0001	<0.0001	0.333
Color Trail Test A (category)	8 (4-8)	7 (3-8)	7 (3-8)	0.0187	0.0424	0.601
Color Trail Test B (category)	8 (6-8)	8 (4-8)	8 (3-8)	0.0126	0.0002	0.0438
Verbal fluency	27.7±9.5	28.7±9.1	28.3±10.0	0.0375	0.3388	0.3544

	Intermediate-High Risk (N=75)	Low Risk (N=81)	P value
Female sex	46 (61.3%)	42 (51.9%)	0.233
Age (year)	82.9±6.8	77.6±7.8	<0.0001
Body mass index, kg/m2	23.3±3.9	25.3±4.4	0.0035
Hypertension	48 (64.0%)	51 (62.9%)	0.893
Diabetes mellitus	34 (45.3%)	21 (25.9%)	0.011
Hyperlipidemia	17 (22.7%)	24 (29.6%)	0.324
Coronary artery disease	37 (49.3%)	26 (32.1%)	0.028
Peripheral artery disease	14 (18.7%)	5 (6.2%)	0.017
Prior myocardial infarction	3 (4.0%)	1 (1.2%)	0.352
Prior stroke or transient ischemic attack	7 (9.3%)	3 (3.7%)	0.352
Chronic kidney disease	37 (49.3%)	10 (12.4%)	<0.0001
Chronic lung disease	5 (6.7%)	7 (8.6%)	0.644
Permanent pacemaker	4 (5.3%)	3 (3.7%)	0.711
STS-PROM, %	8.1±3.8	2.4±0.8	<0.0001
NYHA Fc 3/4	70 (93.3%)	51 (63.0%)	<0.0001
Echocardiography			
LVEF, %	63.3±15.1	66.7±10.4	0.126
Aortic valve area, cm^2	0.75±0.20	0.79±0.15	0.176

Baseline Neurocognitive Function

	Intermediate-High Risk (N=75)	Low Risk (N=81)	P value
NIHSS			
Score	0 (0-0)	0 (0-0)	0.001
Number of score > 0	16 (21.3%)	2 (2.5%)	<0.0001
Barthel index			-
Score	100 (85-100)	100 (100-100)	0.0012
Number of score < 100	28 (37.3%)	12 (14.8%)	0.001
MMSE			-
Score	25 (22-29)	29 (25-30)	<0.0001
Number of score < 26	39 (52.0%)	22(27.2%)	0.001
ADAS-cog	7 (3-11)	1 (0-7)	<0.0001
Color Trail Test A (category)	8 (6-8)	6 (3-8)	0.023
Color Trail Test B (category)	8 (8-8)	8 (4-8)	0.121
Verbal fluency	24.9±9.9	30.4±8.2	0.0002

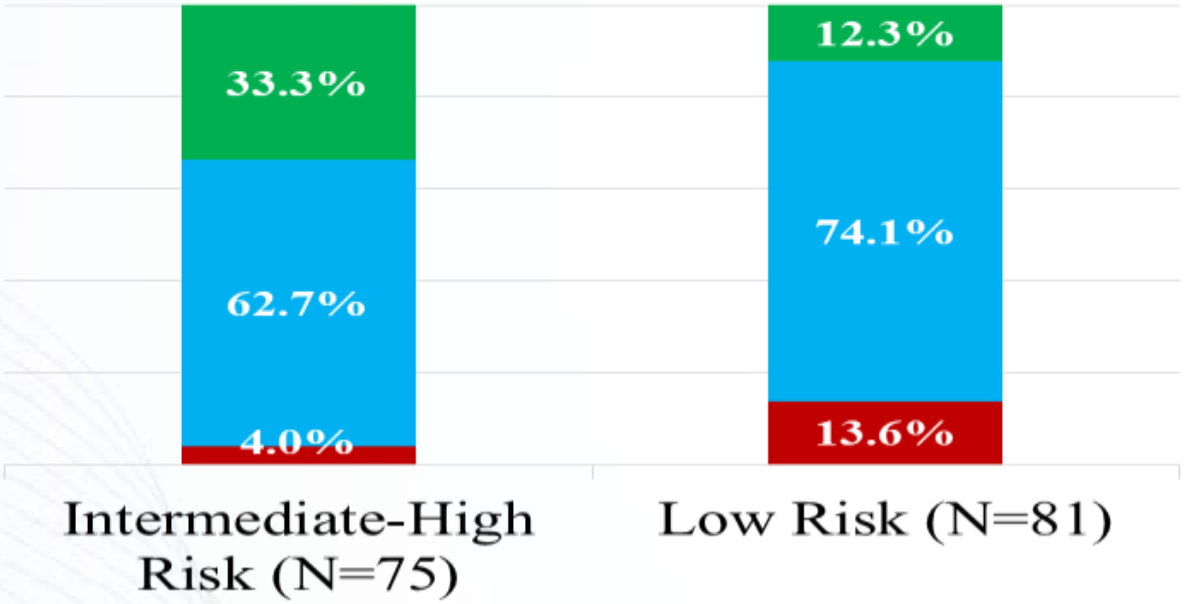
Evolution of Global Cognitive Assessments

	Baseline Evaluation A	3 Month Evaluation B	1 Year Evaluation C	A vs B P value	A vs C P value	B vs C P value
Intermediate-High Risk	N=75	N=75	N=69			
MMSE						
Score	25(22-29)	27(23-29)	27(23-29)	0.0002	0.0017	0.554
Number of score < 26	39 (52.0%)	27(36.0%)	27(39.1%)	0.008	0.006	0.754
ADAS-cog	7(3-11)	4(1-9)	3(1-7)	<0.0001	<0.0001	0.459
Low Risk	N=81	N=81	N=79			
MMSE						
Score	29(25-30)	29(25-30)	29(26-30)	0.398	0.013	0.017
Number of score < 26	22 (27.2%)	22 (27.2%)	14 (17.7%)	1.000	0.109	0.146
ADAS-cog	1(0-7)	1(0-4)	1(0-3)	0.0004	0.005	0.203

Evolution of MMSE

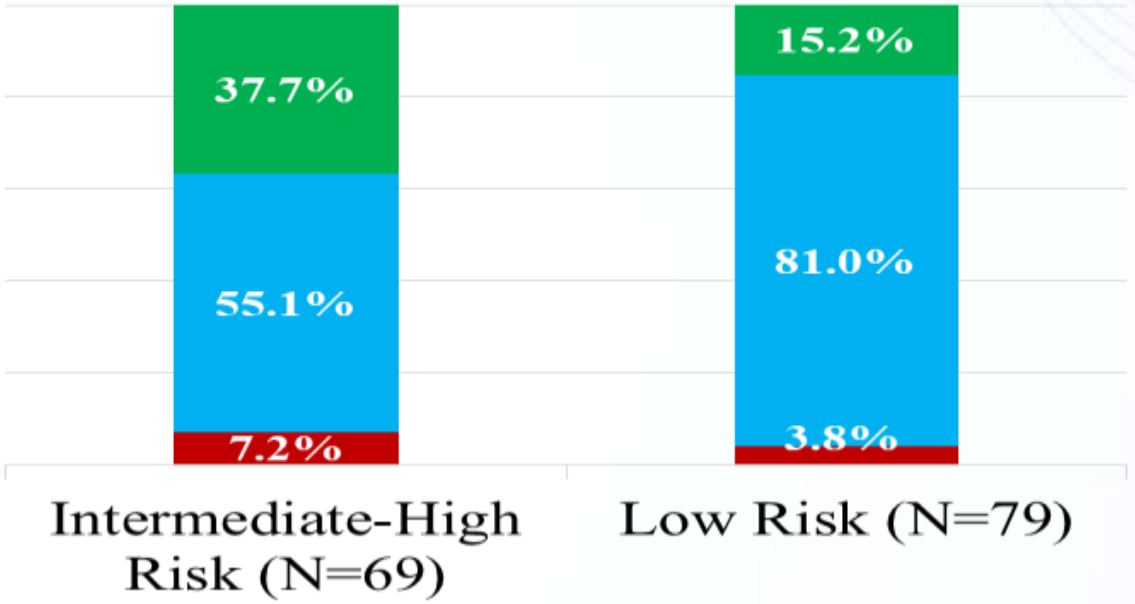
Baseline to 3 months

P=0.002



Baseline to 1 Year

P=0.002



Deterioration
≥3 points decrease in the MMSE score.

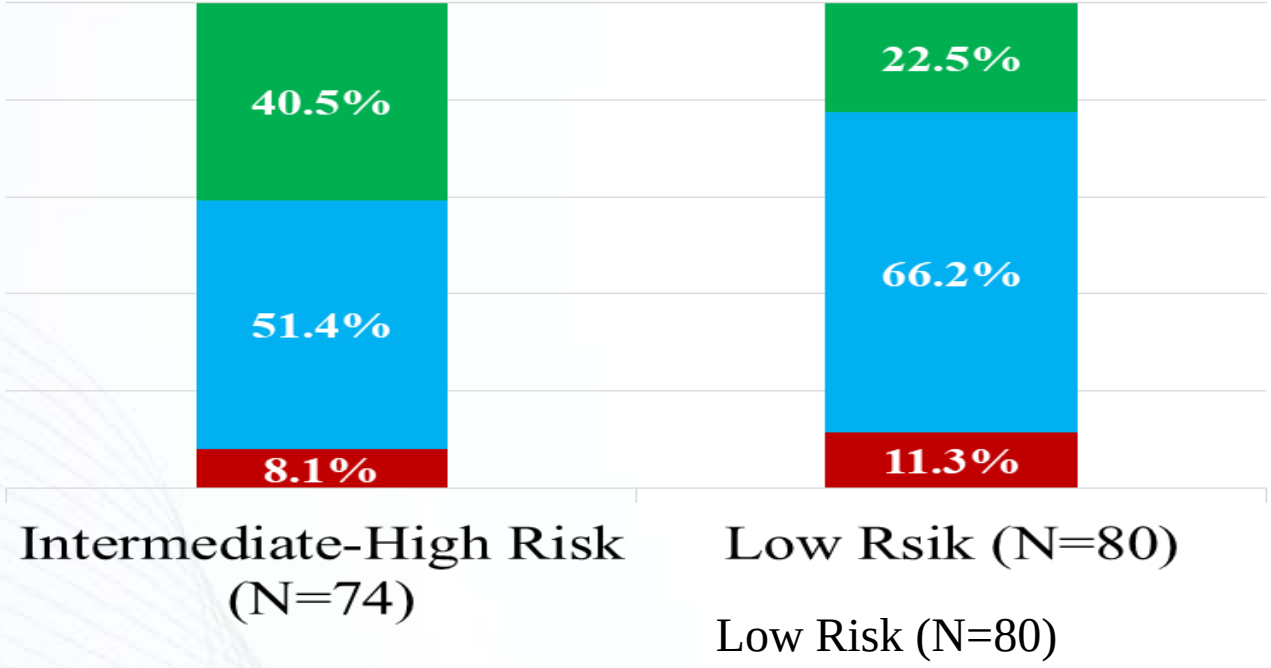
Stable

Improvement
≥3 points increase in the MMSE score

Evolution of ADAS-cog

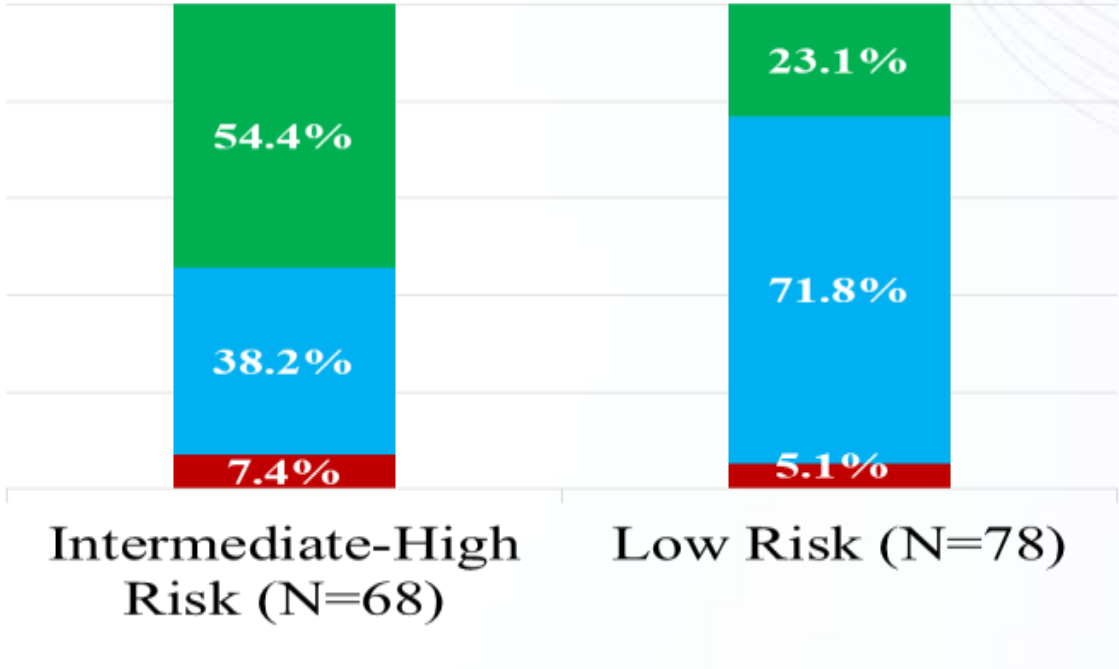
Baseline to 3 months.

P=0.037



Baseline to 1 Year

P=0.001



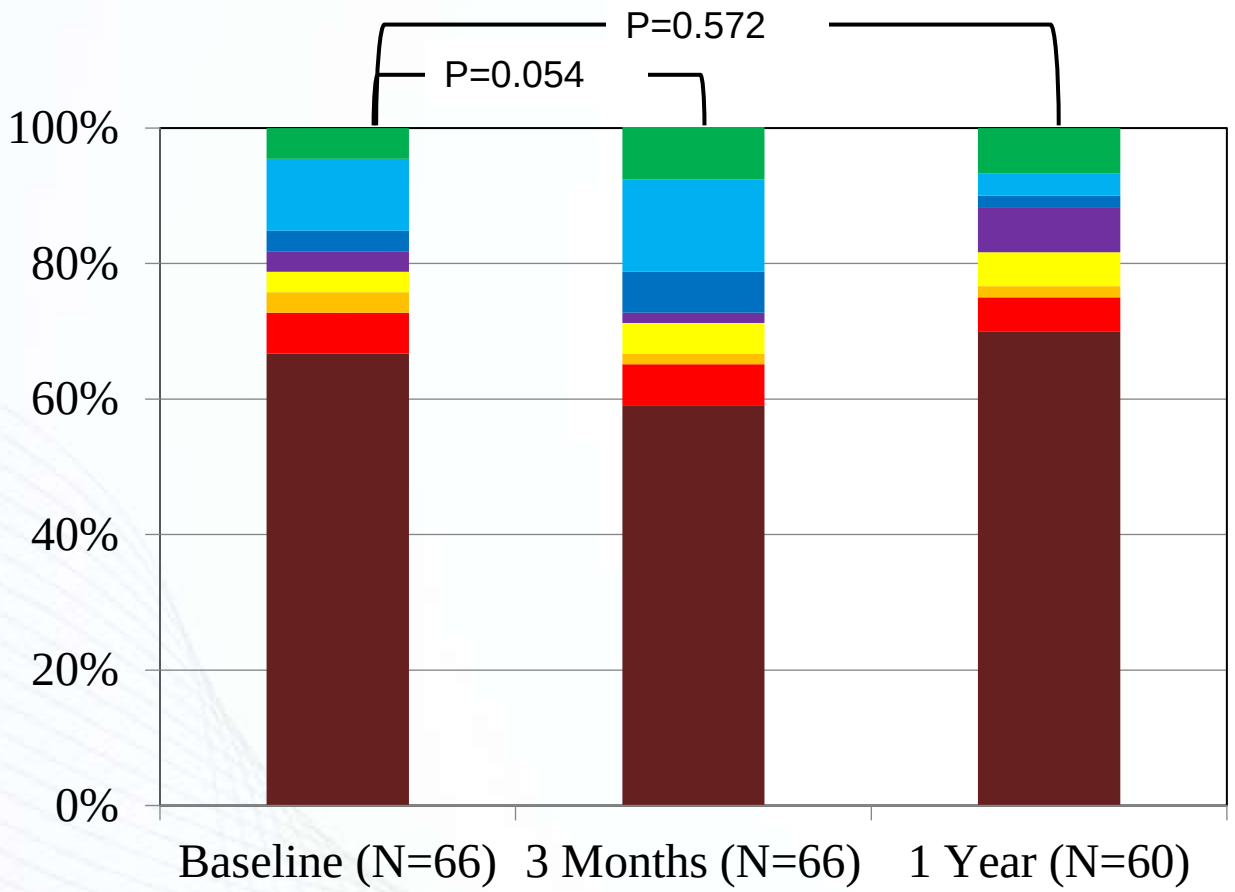
Deterioration
≥3 points increase in the ADAS-cog score.

Stable

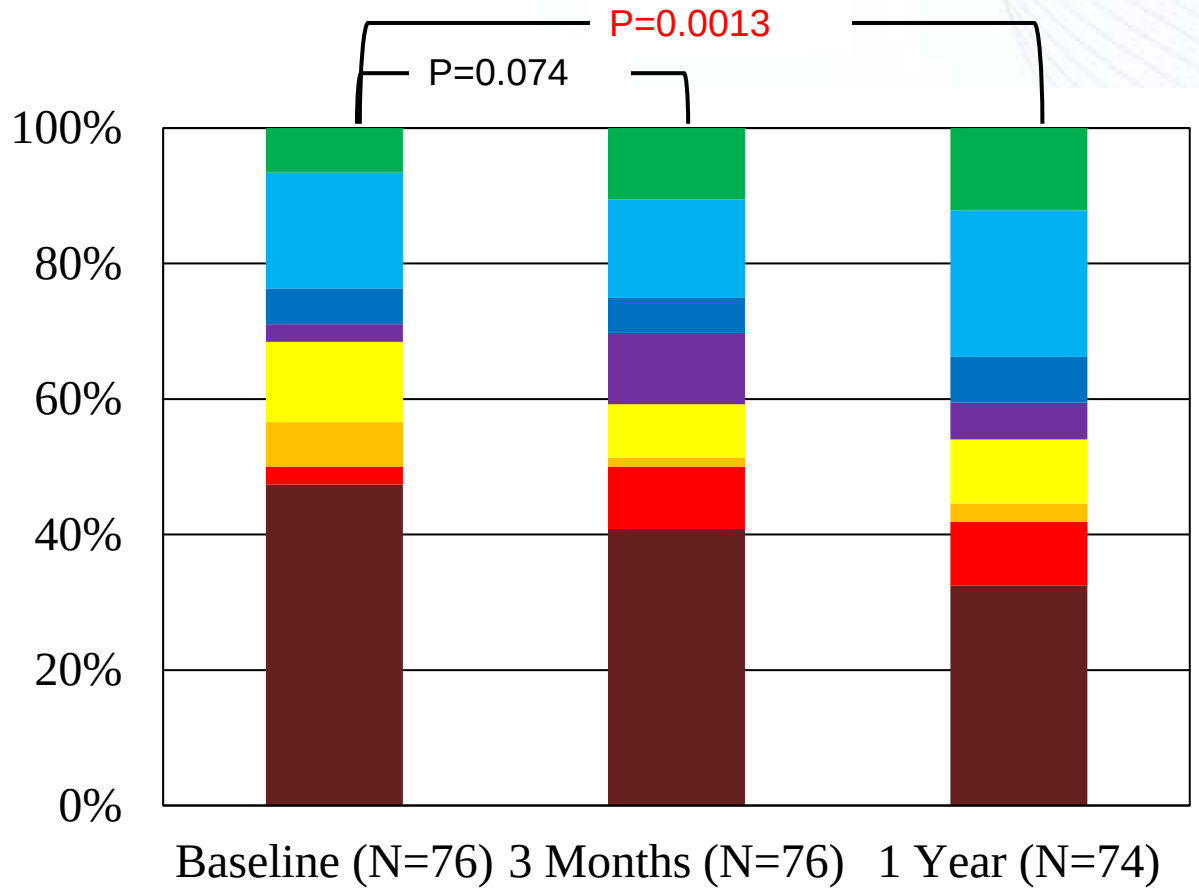
Improvement
≥3 points decrease in the ADAS-cog score

Evolution of Color Trail Test A

Intermediate-High Risk



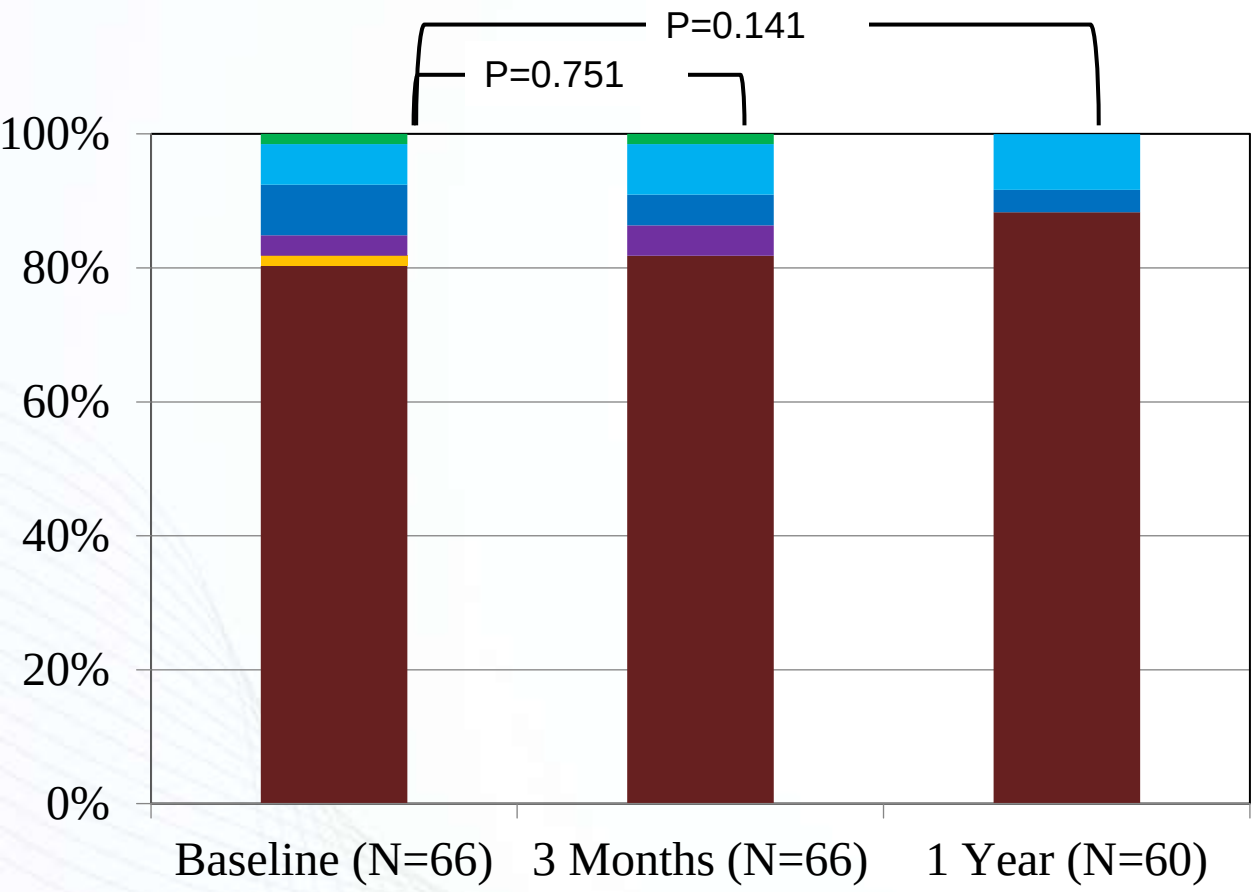
Low Risk



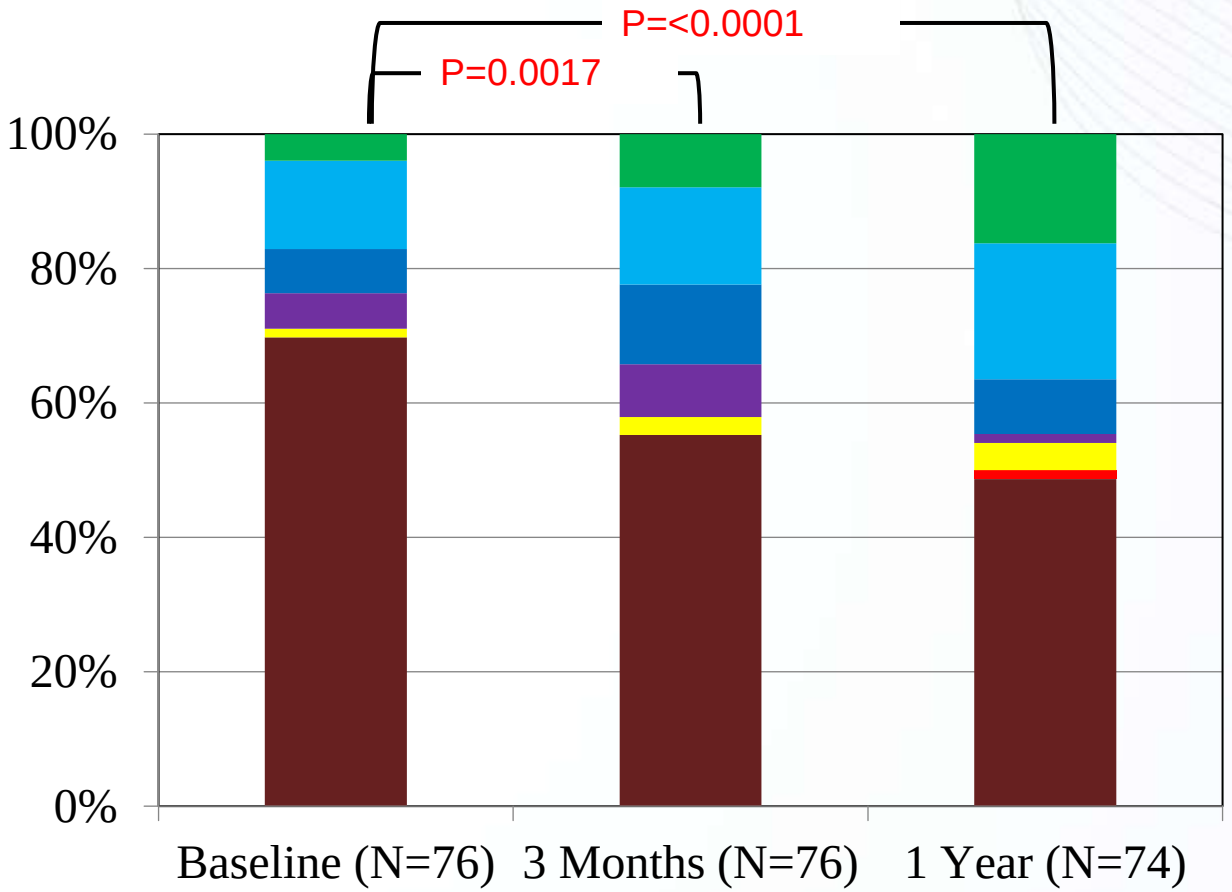
Severely impaired
Moderately-to-severely impaired
Moderately impaired
Mildly-to-moderately impaired
Mildly impaired
Below average
Average
Above average

Evolution of Color Trail Test B

Intermediate-High Risk

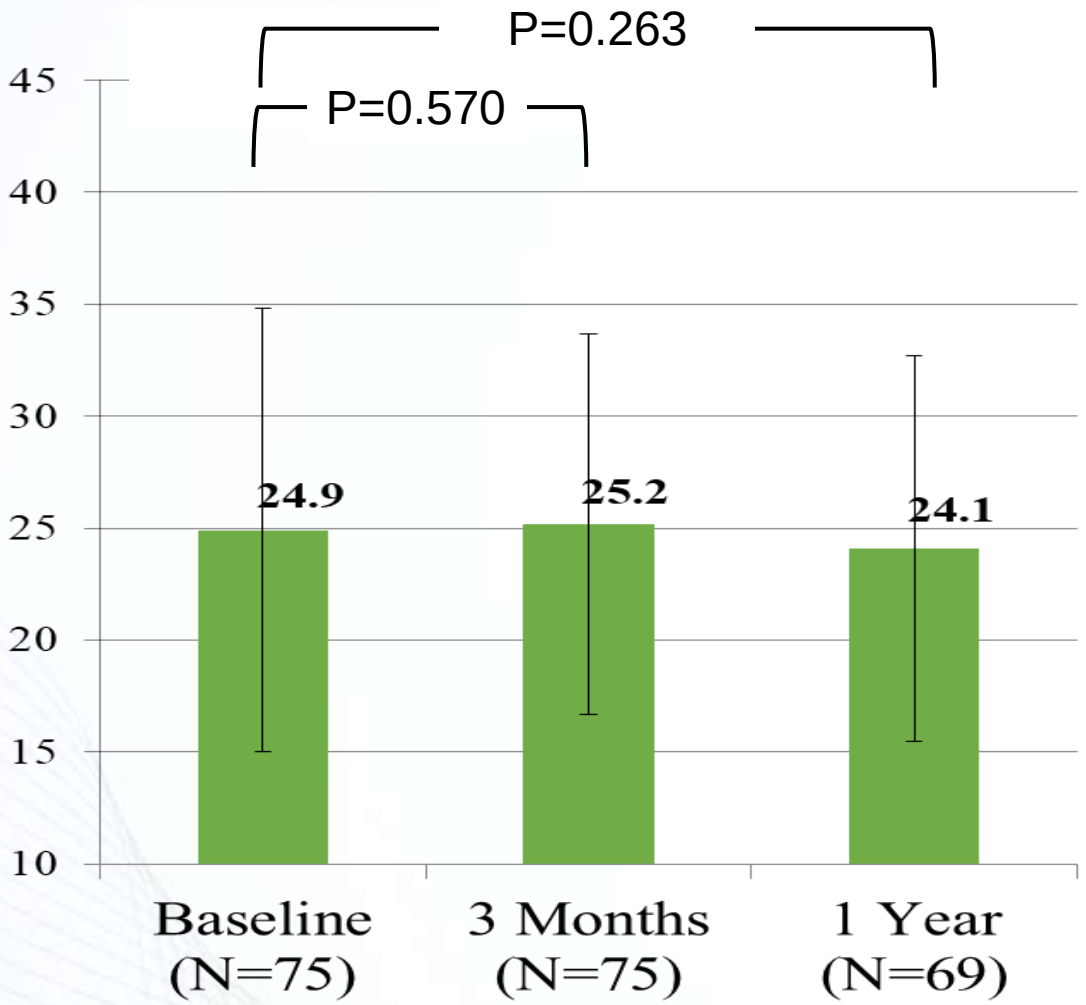


Low Risk

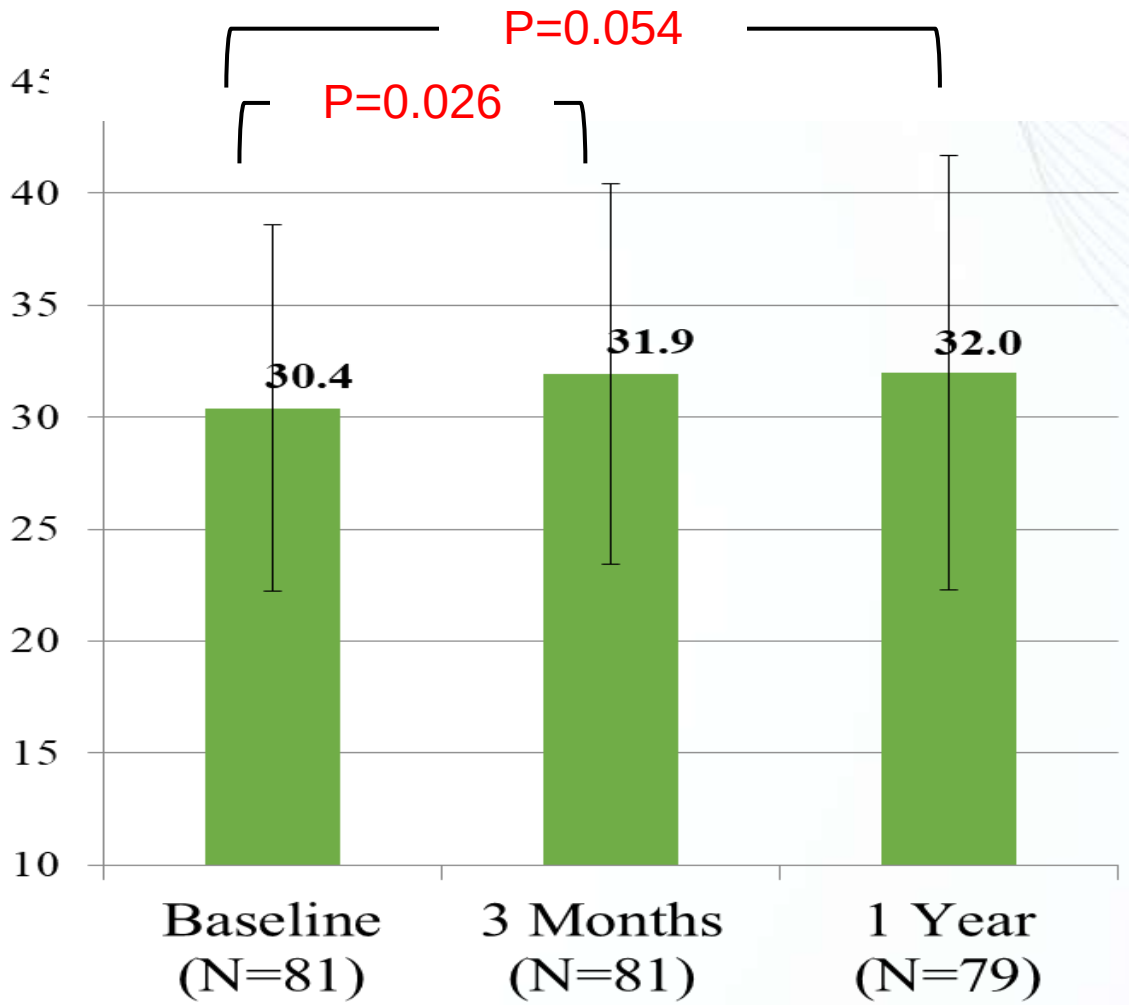


Severely impaired
Moderately-to-severely impaired
Moderately impaired
Mildly-to-moderately impaired
Mildly impaired
Below average
Average
Above average

Evolution of Verbal Fluency



Intermediate-High Risk



Low Risk

Difference of Neurocognitive Trajectory between Low & Intermediate-High Risk Group

- Low risk group:
  - Relatively good cognitive performance at baseline
  - Global cognitive assessment has "ceiling effect"
  - Subtle cognitive change could be detected by complex executive tests
- Intermediate-High risk Group:
  - Relatively poor cognitive performance at baseline
  - Global cognitive tests are sensitive in this group
  - Executive function were mostly impaired
  - High executive tests has "floor effect"

Limitations

- Patients who were excluded & died may deliver a potential bias
- Brain magnetic resonance imaging were not applied and new cerebral DWI lesions were not examined.
- The effects of operator experience and device evolution within the study period cannot be controlled.

Implications for Further Studies

- Embolic protection device studies
- Homogeneous population & tests are mandatory

Conclusion

- TAVR was associated with improvement in global cognitive functions, as well as in attention and psychomotor processing speed, at 3 months post-TAVR and persistent up to 1 year.
- Global cognitive changes could be detected more in intermediate-high risk group
- The executive tests revealed more cognitive improvement in low risk group.