Erasmus MC
Universitair Medisch Centrum Rotterdam

Cancer Institute

brain tumor center

Neurocognitive assessment and patient reported outcomes

ESMO preceptorship programme: Brain tumours
Athens, 28-29 September

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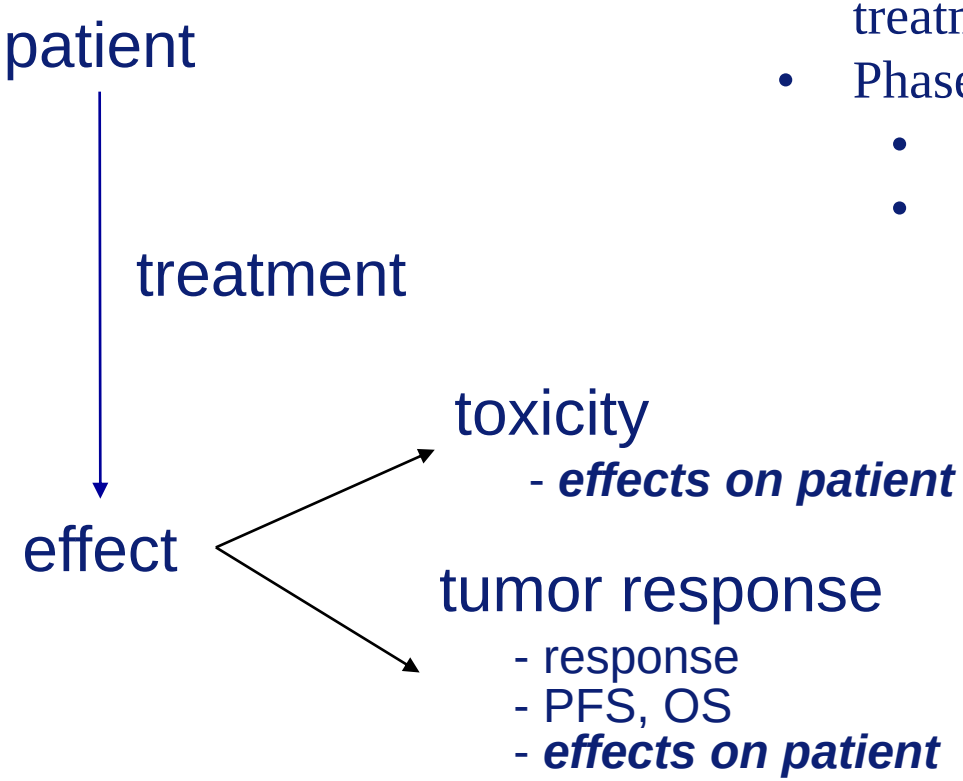
disclosures

- Honoraria from Celgene, BMS, Abbvie, Agios, Boehringer, Bayer, Carthera

Outcome assessment in primary brain tumors

- Every day clinical practice: guidance of treatment: response
- Phase II trials: evaluation of novel treatments: ORR, PFS, OS
- Phase III trials:
  - PFS, OS
  - ***Patient benefit: improved or decreased functioning***



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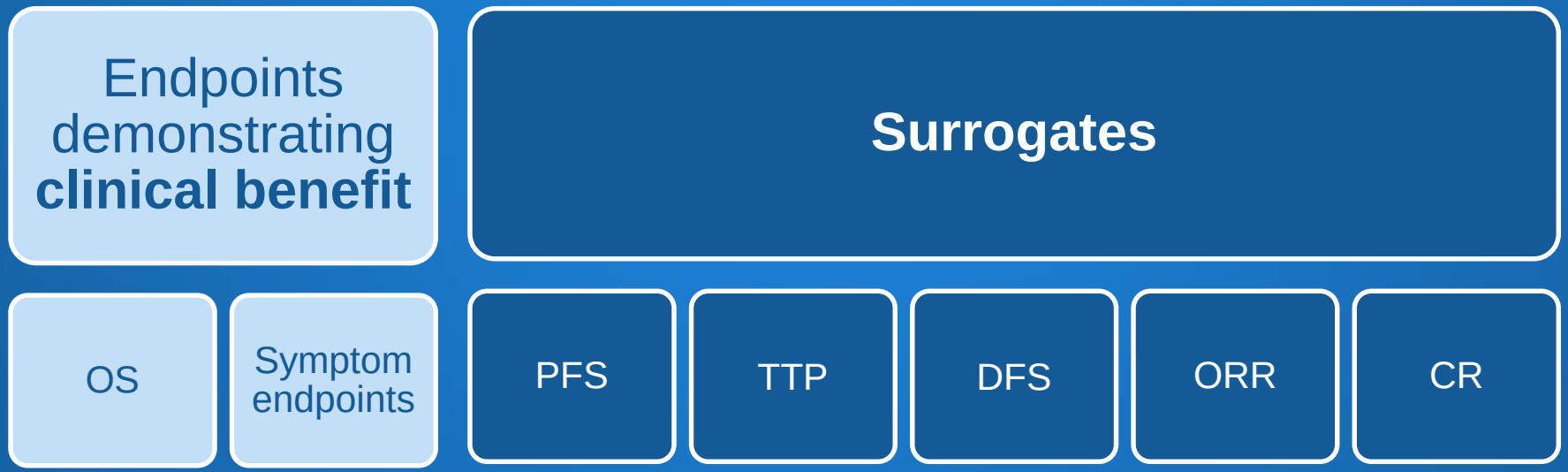
FDA opinion on oncology endpoints

- Only OS and symptom endpoints are sufficient to demonstrate **clinical benefit** for regular approval[1]
- Improvement in surrogate endpoints reasonably likely to predict benefit may be sufficient to gain accelerated approval
  - Adequacy of surrogates is highly dependent upon other factors such as effect size, effect duration, and benefits of other available therapy[1]
- Tumor-specific guidance on endpoints still awaited[2]



CR: complete response.; ORR: objective response rate; TTP: time to progression

1. www.fda.gov/cder/guidance/index.htm;
2. www.fda.gov/Drugs/DevelopmentApprovalProcess/DevelopmentResources/CancerDrugs/ucm094586.htm

Auxiliary Endpoints
Patient Function and Well-Being

- Tumor specific
  - May address disease specific clinical issues
- Candidates in neuro-oncology
  - Corticosteroid use
  - Neurocognitive assessment
  - Health-related quality of life
  - Performance status change over time
  - Seizures
- Patient derived vs doctor derived
  - **Patient Reported Outcome (PRO)**

Assessment of late toxicities affecting quality of survival

Carle van Loo (Nice 1705 - Paris 1765) Bacchus and Ariadne

Rubens (1577-1640)
Drunken bacchus

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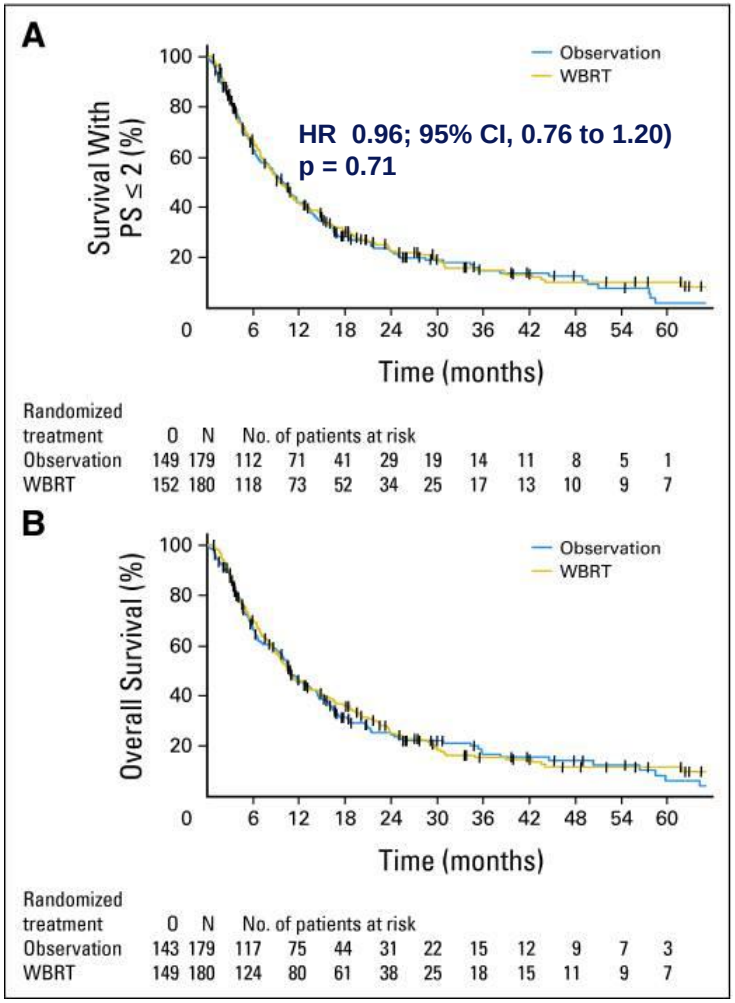
Management of brain metastases after surgery or SRS

- Resection or SRS of 1-3 brain metastases improves outcome of patients with controlled systemic disease
- OS is determined by systemic disease in majority of patients
- WBRT administered after surgery or SRS improves local and brain control
- WBRT given after surgery or SRS of 1-3 brain metastases does not improve OS
- Does improved local control matter for patients?

EORTC 22952: WBRT vs observation (OBS) after surgery or SRS for 1-3 brain metastases

- n = 359, eligible with PS 0-2
- Primary endpoint: time to PS WHO > 2
- The median time to WHO PS > 2
  - Obs: 10.0 mo (95% CI, 8.1 to 11.7)
  - WBRT: 9.5 mo (95% CI, 7.8 to 11.9)
- 2 years: OBS 22.3% and WBRT 22.6% alive and functionally independent
- Extracranial progression (death as competing risk) at 2 yrs:
  - OBS: 63% (95% CI, 56% to 70%)
  - WBRT 65% (95% CI, 58% to 72%) (p = 0.73)



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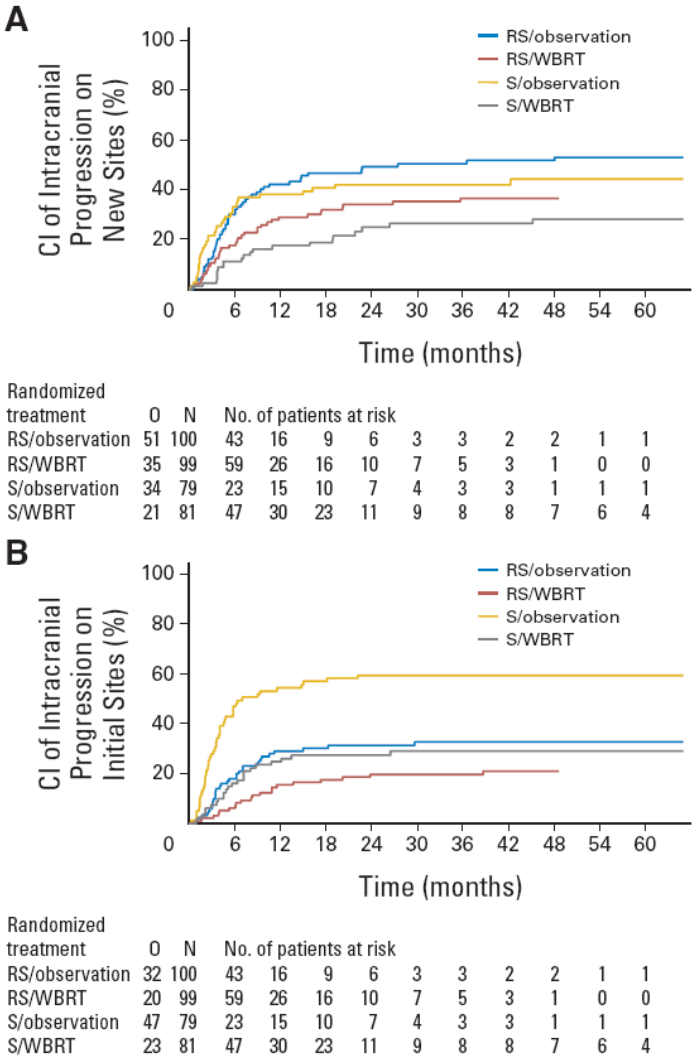
Risk of intracranial PD

- At 2 yrs: WBRT after radiosurgery reduced the probability of relapse at
  - initial sites: from 31% (95% CI, 22%to 40%) to19%(95% CI,11%to 27%; *P* = .040)
  - at new sites: from 48% (95% CI, 38% to 58%) to 33% (95% CI, 24% to 43%; p = 0.0023

➢ Improved local control, no impact on survival: does it matter?



Kocher et al, *J Clin Oncol 2010 29:134-141*

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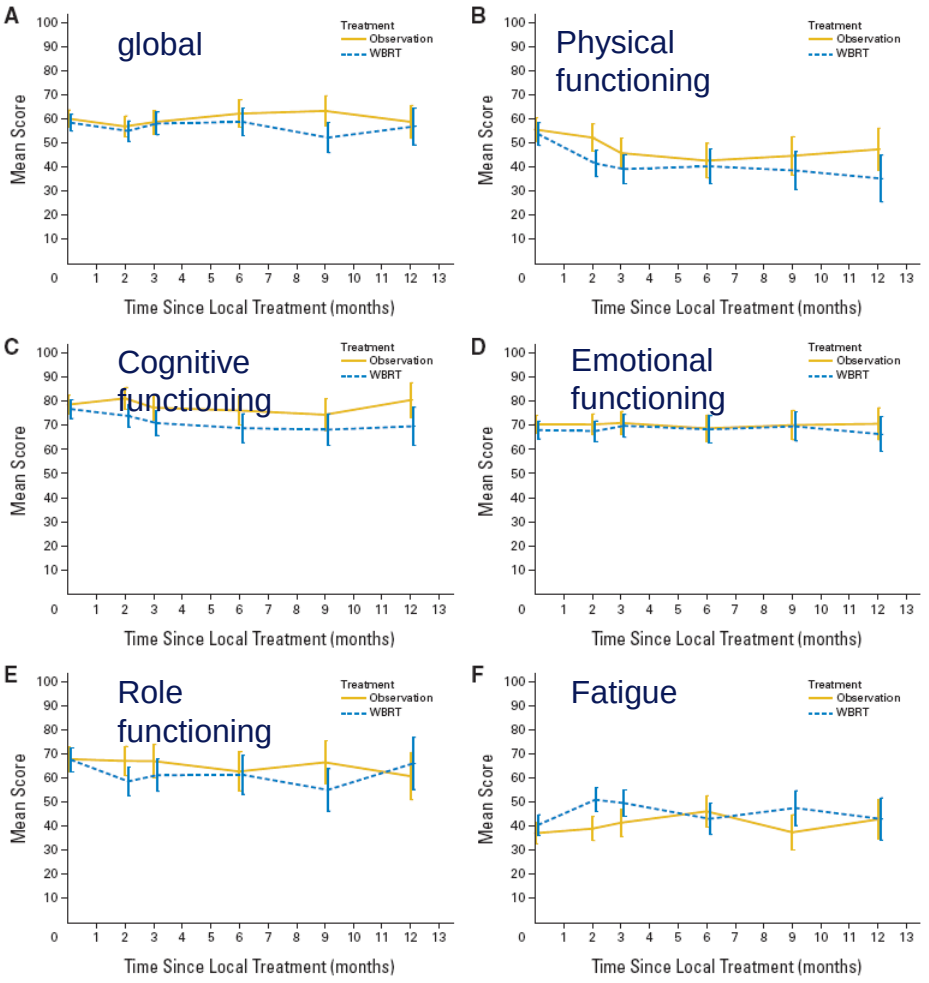
EORTC 22952: WBRT vs observation (OBS) after surgery or SRS for 1-3 brain metastasesL QoL

- Health related quality of life using QoL C30 and BCM20
- Change of 10 points considered clinically relevant
- OBS patients better HRQOL scores than WBRT patients
- Statistically significant and clinically relevant
  - global health status at 9 mo,
  - physical functioning at 8 wks
  - cognitive functioning at 12 mo
  - fatigue at 8 wks



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Soffietti et al, *J Clin Oncol 2012;31:65-72*

SRS vs no SRS after resection brain metastases

- N = 132 patients, 4 ineligible
- Primary endpoint: time to local recurrence
- 12-mo freedom from local PD:
  - 43% (95% CI 31–59) without SRS
  - 72% (60–87) in the SRS group
- median overall survival
  - 18 mo (95% CI 13 months to NR) without SRS
  - 17 mo (13–22) in the SRS group
- 12-mo freedom from distant brain PD
  - 33% (95% CI 22–49) without SRS
  - 42% (30–58) in SRS group

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Mahajan et al, Lancet Oncol 2017; 18: 1040–48

Conclusion

- SRS of the surgical cavity in patients who have had complete resection of one, two, or three brain metastases significantly lowers local recurrence compared with that noted for observation alone.
  - Thus, the use of SRS after brain metastasis resection could be an alternative to whole-brain radiotherapy
  - Treating the surgical cavity postoperatively with SRS is an appealing strategy to limit the neurocognitive insult while improving local tumour control.
- Burning question: does local control matter?
  - No impact OS
  - No impact on distant brain control (WBRT does!)
  - Impact on patient functioning not reported

WBRT revisited: SRS vs WBRT

- 194 patients randomized to SRS or WBRT
- The co-primary endpoints were overall survival and cognitive-deterioration-free survival
- Cognition assessed with 6 well established cognitive tests to assess learning and immediate memory
- Median OS 12·2 months (95% CI 9·7–16·0, 69 deaths) for SRS and 11·6 months (9·9–18·0, 67 deaths) for WBRT
- Cognitive-deterioration-free survival longer after SRS (median 3·7 months [95% CI 3·45-5·06]) compared to WBRT (median 3·0 months [2·86–3·25])

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Brown et al, Lancet Oncol 2017; 18: 1049–60

- **Decline in cognitive function was more frequent with WBRT than with SRS and there was no difference in overall survival between the treatment groups.**

Young sick bacchus
Caravaggio, 1593

Assessment cognition

- 6 tests: Hopkins Verbal Learning Test-Revised [HVLT-R] Immediate Recall), verbal fluency (Controlled Oral Word Association Test [COWAT]), processing speed (Trail Making Test part A [TMT-A]), executive function (Trail Making Test part B [TMT-B]), delayed memory (HVLT-R Delayed Recall), and recognition (HVLT-R Recognition).
- Cognitive-deterioration-free survival: the time from randomisation to a drop of greater than 1 SD from baseline in at least one of the six cognitive tests (all tests are standardised on the basis of published norms
- Secondary endpoints were quality of life (change from baseline to 6 months in FACT-Br and LASA), functional independence (assessed by the Barthel ADL index), local surgical bed recurrence, local recurrence of unresected metastases, distant brain recurrence, development of leptomeningeal disease, intracranial progression (time from randomisation to recurrence in the local surgical bed, progression of unresected metastases, distant brain recurrence, or development of leptomeningeal disease), long-term cognitive status, and toxicity.

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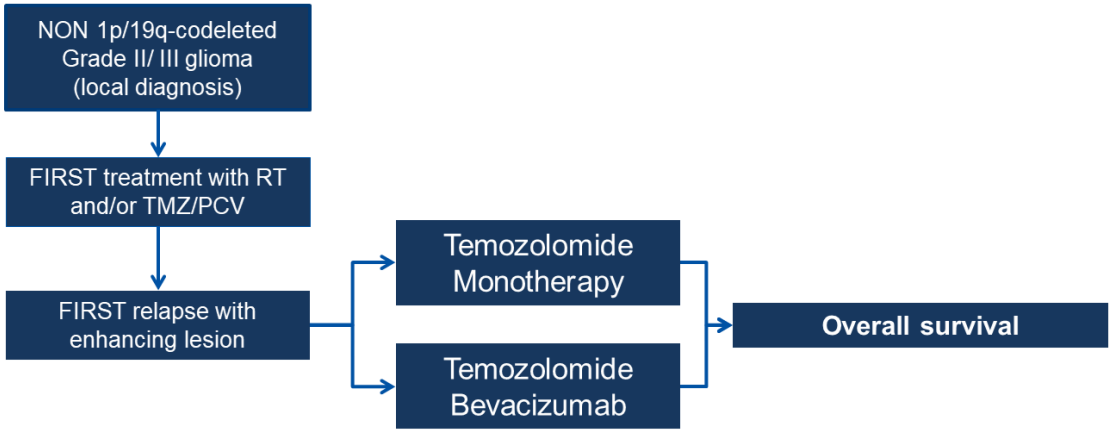
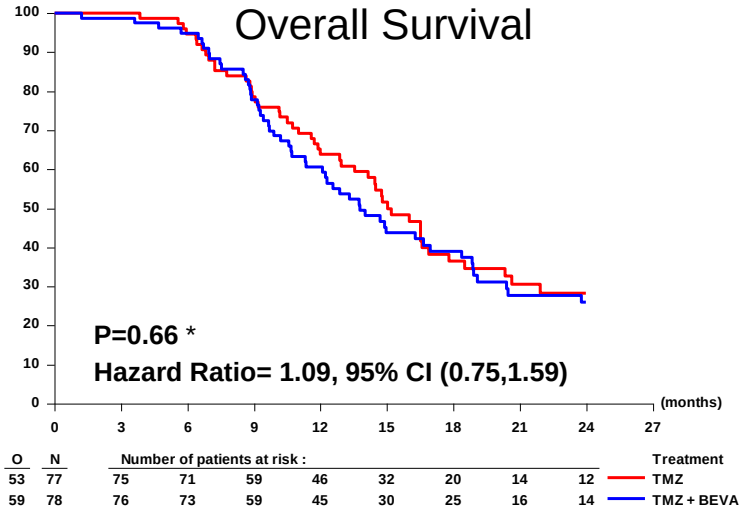
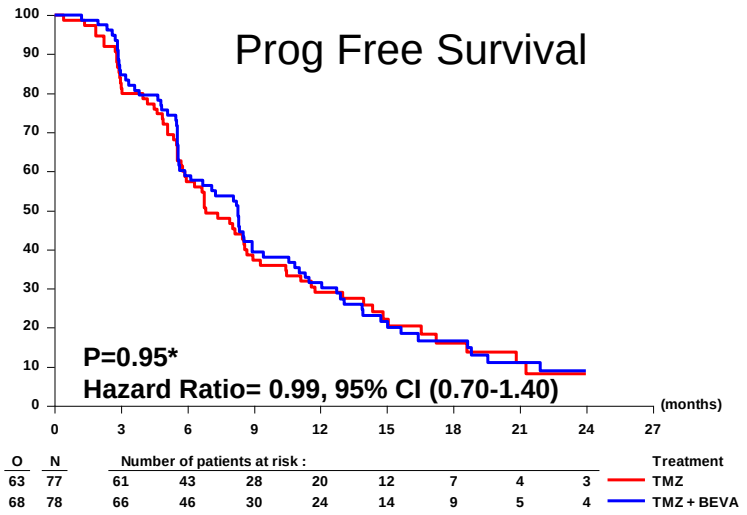
Cognitive Domain	Test	Time to Administer (minutes)
Memory	Hopkins Verbal Learning Test–Revised	8
Visual-motor processing speed	Trail Making Test Part A	5
Executive Function	Trail Making Test Part B	7
Verbal fluency	Controlled Oral Word Association	5
		Total time: 25 minutes

- Dutch, English (US, UK), French, German, Italian, Spanish, Catalan, Hebrew, Turkish, Portuguese
- 6 parallel versions
- Sensitive to the impact of cancer & neurotoxic effects of cancer treatment
- Routinely used in EORTC studies

EORTC TAVAREC trial: bevacizumab and temozolomide in recurrent 1p/19q intact grade II / III glioma







PP population		TMZ alone N=73	TMZ + BEV N=70
Primary endpoint	**Patients alive at 12m***	**44:72st (61%)**	**39:70 (56%)**

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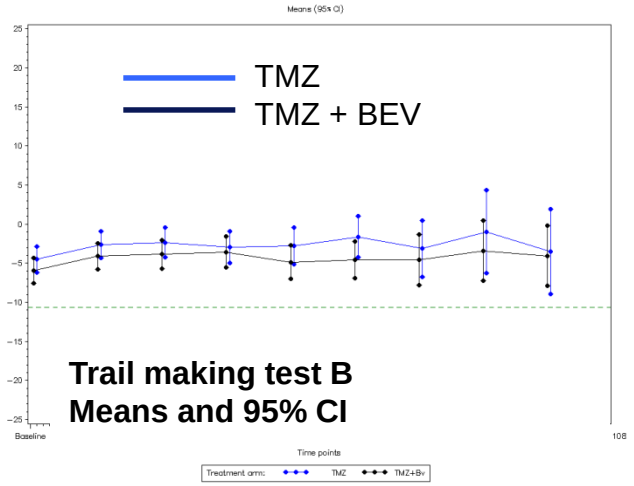
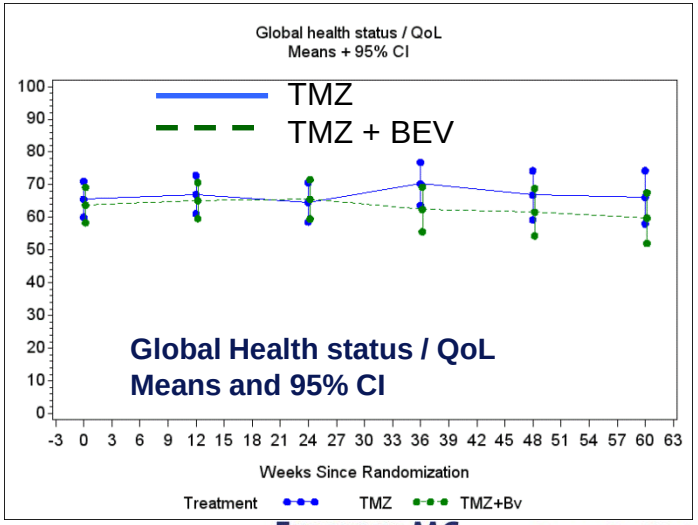
van den Bent et al, Lancet Oncol 2018doi: 10.1016/S1470-2045(18)30362-0

EORTC TAVAREC: Analysis QoL, cognition

- No clinical significant differences (ie > 10 points) were found at any time point for Global Health (p = 0.26), Cognitive Functioning (p = 0.13) or Pain (p=0.24)
- No impact on Cognition
  - For all 6 tests: none of the null hypothesis of no difference (H0) rejected
- TAVAREC conclusion:
  - No difference OS, PFS
  - No clinically better functioning in BEV/TMZ arm





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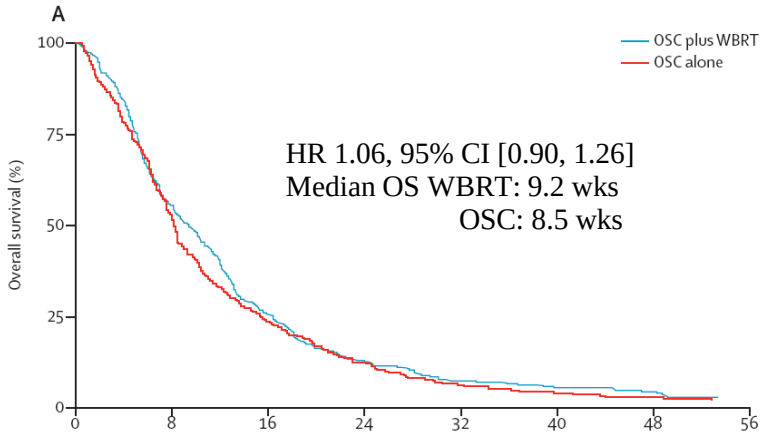
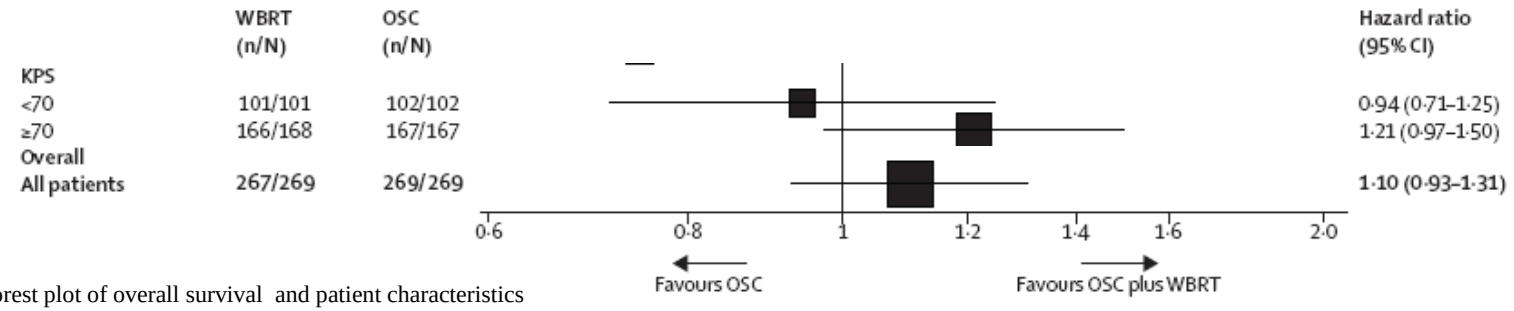
van den Bent et al, Lancet Oncol 2018doi: 10.1016/S1470-2045(18)30362-0

The QUARTZ trial: a new perspective on WBRT in NSCLC

- Design: optimal supportive care vs OSC with WBRT 20 Gy in 5 fractions
- Eligible: NSCLC patients with radiologically proven brain mets
  - Not candidate for surgery or SRS
- N = 538
  - KPS < 70 38%, ≥ 70 62%
  - Uncontrolled primary: 64%
- Non-inferiority trial, primary endpoint: QALY

➢ No OS difference in outcome between arms





Forest plot of overall survival and patient characteristics

➢ Still to be considered for good KPS patients

Mulvenna et al, Lancet 2016;388:2004-14

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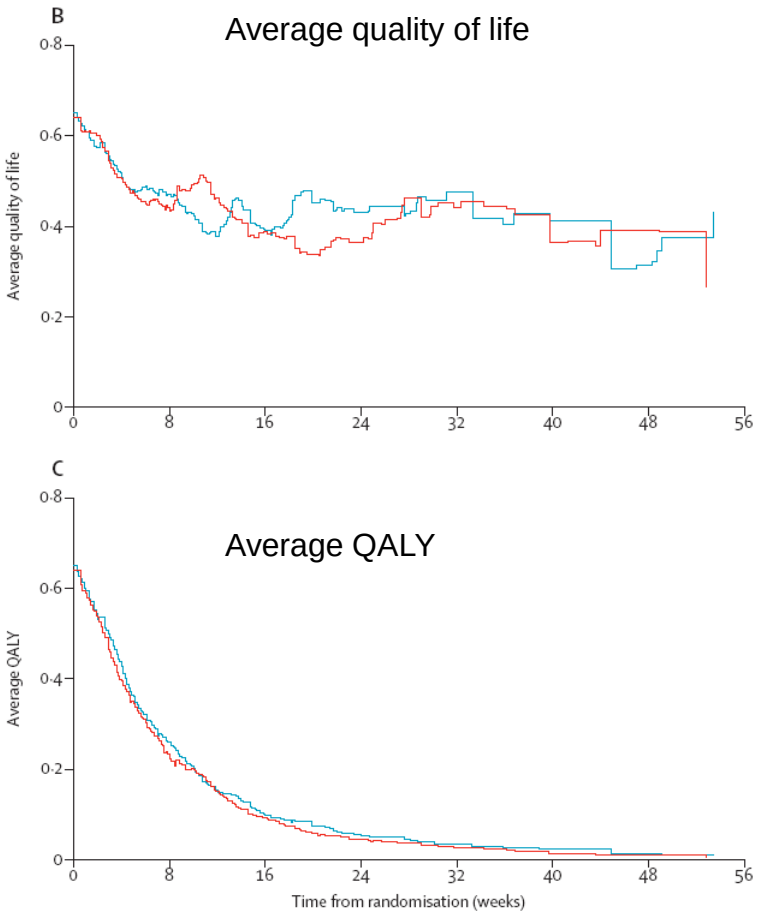
QUARTZ trial: primary endpoint

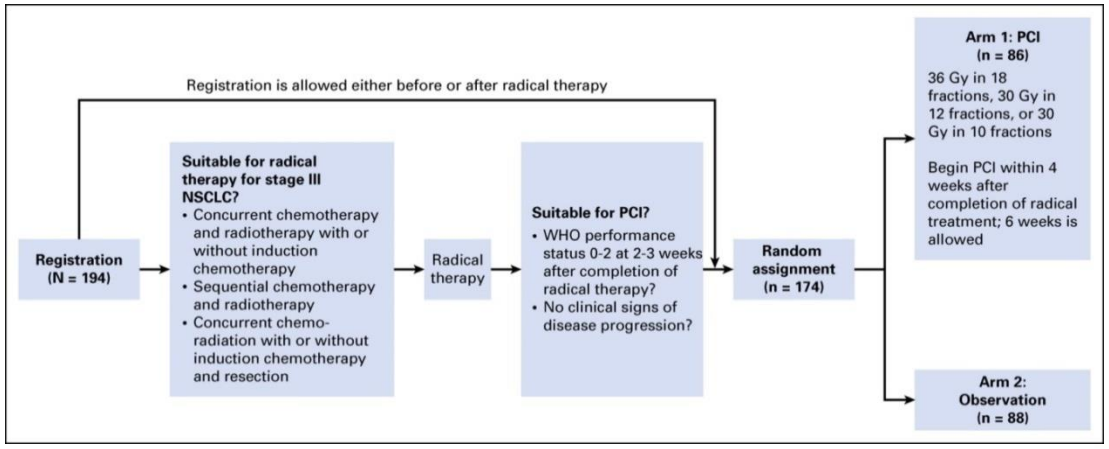
- Primary endpoint was quaity-adjusted life years
  - Combined measure of survivor function and utility
- Assessed with EuroQol EQ-5D 3L questionnaire
- Non-inferiority design
- No difference between groups



Mulvenna et al, Lancet 2016;388:2004-14

New trial on PCI for radically treated stage III NSCLC

- Primary end point: development of **symptomatic** brain metastases at 24 mo defined by development of
  - Key symptoms: one or a combination of signs of increased intracranial pressure, headache, nausea and vomiting, cognitive or affective disturbances, seizures, and/or focal neurologic symptoms
  - Mandated imaging
- AE event assessment CTC for adverse events 3.0
- QoL assesssment with QoL C30 and BN20, EuroQol 5D
- n = 172



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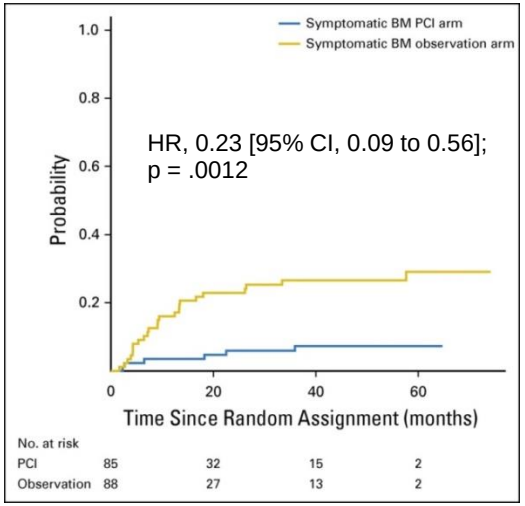
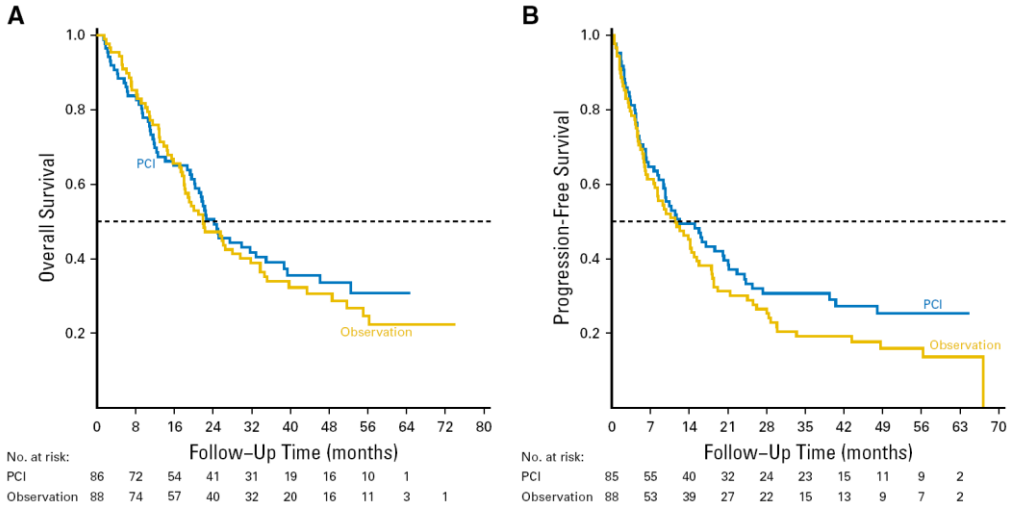
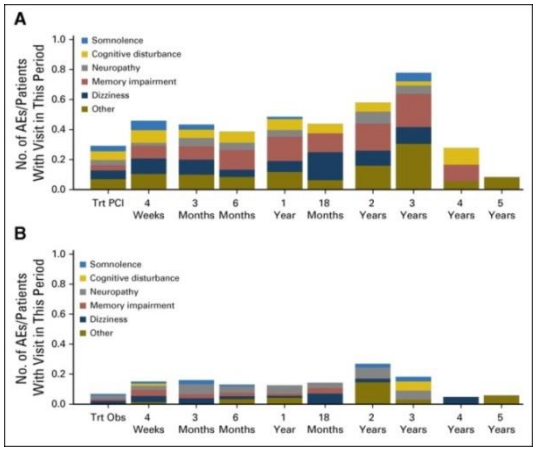
Ruysscher et al, J Clin Oncol Clin Oncol 2018;36:2366-2377

New trial on PCI for radically treated stage III NSCLC

- 6 (7.0%) of 86 patients PCI group vs 24 (27.2%) of 88 patients control group symptomatic brain metastases (p = .001)
- PCI increased time to develop symptomatic brain metastases (hazard ratio, 0.23; [95%CI, 0.09 to 0.56]; p = .0012).
- Less symptomatic brain metastases but no difference in Overall Survival







- After PCI more neurologic AEs, most low grade (grade 1 and 2)

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PCI: quality of survival

- Physician scored AE: Significantly increase in grade 1 / 2 memory impairment (30% v 8%, respectively) and cognitive disturbance (19% v 3%, respectively
- Virtually all AEs under-reported by physicians compared with patients
  - Memory impairment was reported by 57% and 54% of patients in the PCI arm and observation arm
  - ➢ Fatigue and memory impairment more under-reported by physicians in the observation arm than in the PCI arm.
- Reflecting bias of physicians? **Requires PRO's and objective assessment…**
- OS and progression-free survival similar in both arms
  - PCI is efficacious in reducing the incidence of brain metastases
  - Majority of patients developed extracranial recurrences, thus lowering the potential effect of PCI on OS
  - Effect of treatment of symptomatic (CNS) metastases

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Some conclusions

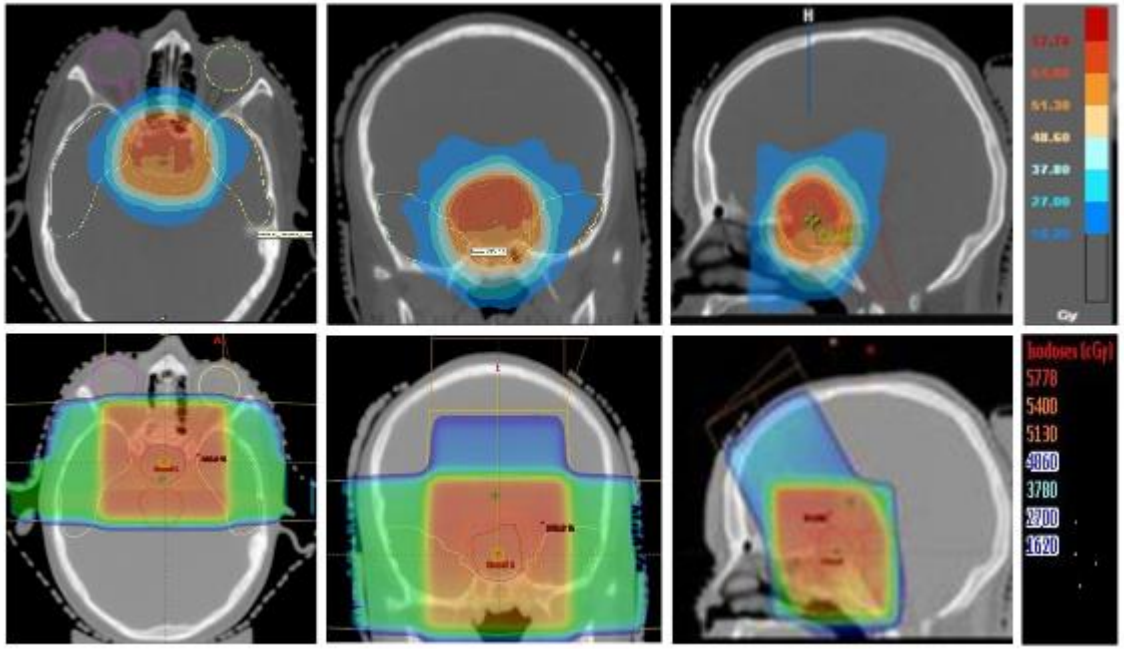
- Non-survival endpoints may help to assess quality of survival, as another measure of patient benefit
- Challenge: patient, physician compliance
- Different tools, different advantages
- Especially relevant in treatments that
  - Improve survival by intensified treatment: impact functioning
  - Similar OS but different PFS
  - Aim at symptom control

Patient perception vs doctor perception?

Cornelis de Vos, 1651 – El triumfo de baco…

Efficacy of Stereotactic Conformal Radiotherapy vs Conventional Radiotherapy on Benign and Low-Grade Brain Tumors

- Randomized comparison of stereotactic conformal radiotherapy (SCRT) compared with conventional radiotherapy (ConvRT) in young patients with residual and/or progressive benign or low-grade brain tumors
- The primary end points of the study were incidence and magnitude of neurocognitive and neuroendocrine dysfunctions in both arms



Stereotactic conformal RT

Conventional radiotherapy

Jalali et al, *JAMA Oncol*. 2017;3(10):1368-1376

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Outcome

- N = 200, median age 13
- Mean global intelligence quotient (IQ) and performance IQ scores over 5 years were superior after SCRT compared to ConvRT
- Cumulative incidence of new neuroendocrine dysfunction at 5 years lower in SCRT patients compared to ConvRT (31% vs 51%; *P* = .01)
- Developing a new neuroendocrine axis dysfunction in patients with dysfunction at baseline also lower in the SCRT arm compared with the ConvRT arm (29% vs 52%; *P* = .02).
- Five-year OS in SCRT and ConvRT arms was 86% and 91%, respectively (*P* = .54).

Jalali et al, *JAMA Oncol*. 2017;3(10):1368-1376

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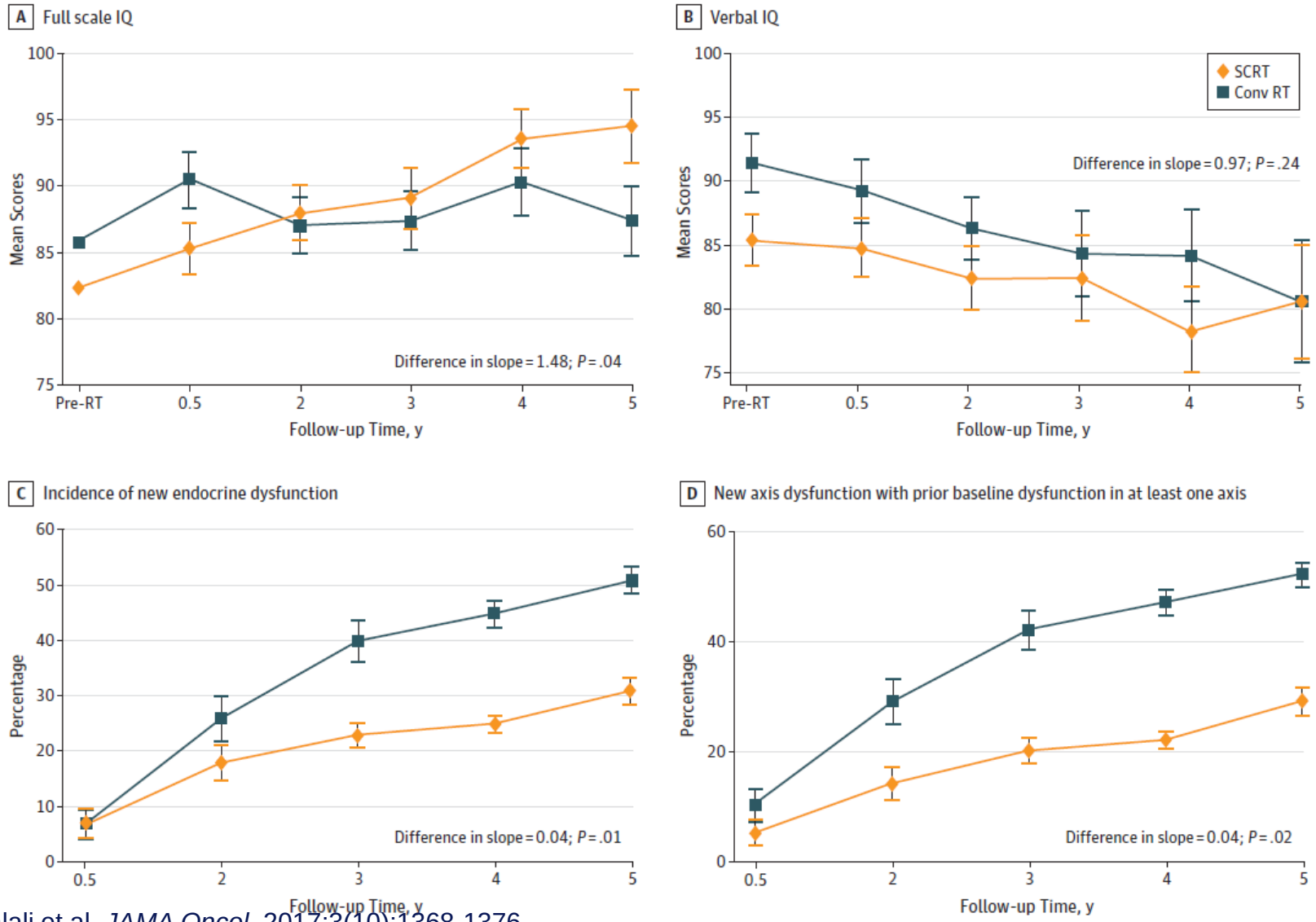

Jalali et al, *JAMA Oncol*. 2017;3(10):1368-1376