

# DECREASING THE PREVALENCE AND RISK OF POSTOPERATIVE DELIRIUM & POCD

BECKER'S HOSPITAL REVIEW WEBINAR SERIES NOV. 11, 2016

JOSEPH R. TOBIN, M.D.  
EMERITUS PROFESSOR AND FORMER CHAIRMAN  
DEPARTMENT OF ANESTHESIOLOGY  
WAKE FOREST UNIVERSITY SCHOOL OF MEDICINE  
JTOBIN@WAKEHEALTH.EDU

# GOALS AND OBJECTIVES

- Define Postoperative delirium (POD) and Postoperative Cognitive Dysfunction (POCD)
- Describe the impact on patient outcomes
- Review economic implications for hospitals & healthcare systems
- Provide a strategy to educate staff & increase awareness of POD/POCD
- Summarize

# POSTOPERATIVE DELIRIUM (POD)

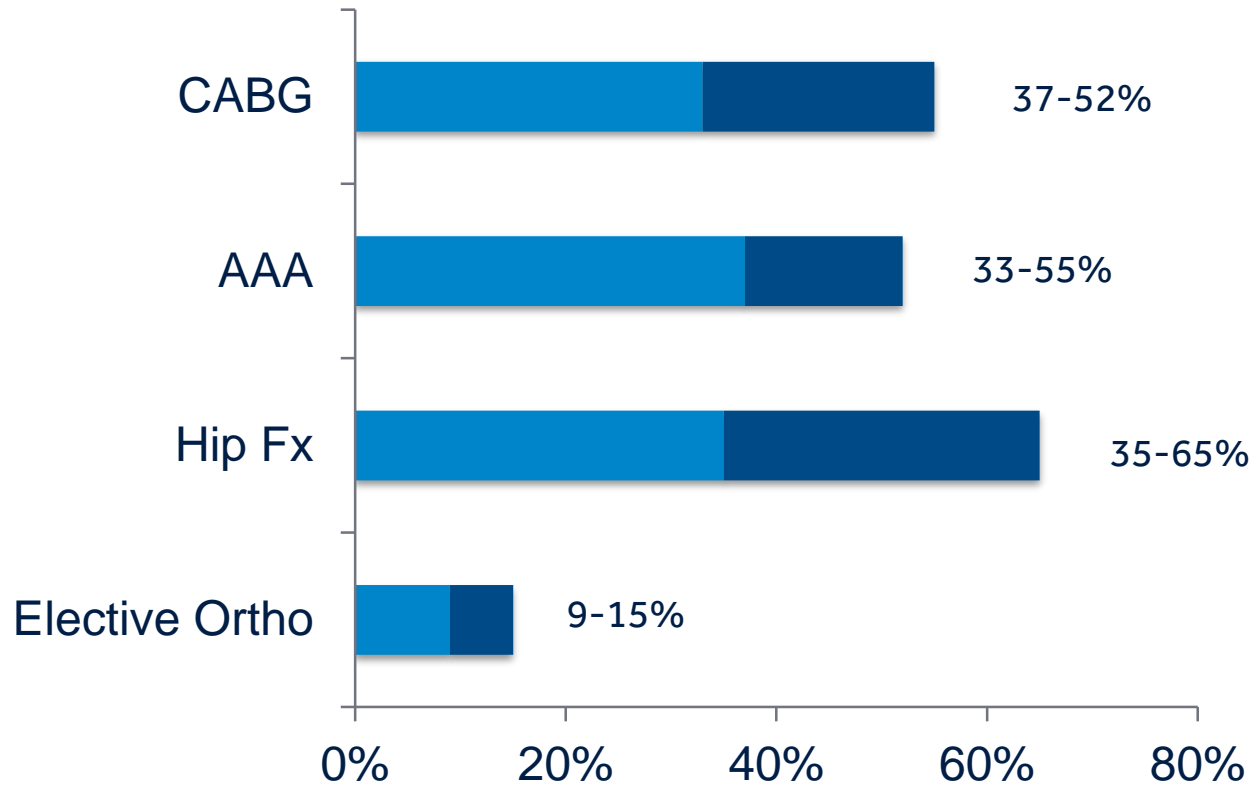
- POD is an acute change in cognition characterized by inattention, altered level of consciousness and/or disorganized thinking, which may include hallucinations<sup>1</sup>
- Presentations can be hypoactive or hyperactive<sup>1,2</sup>
- Etiology is multifactorial including anesthetic, electrolyte, aging, & surgical inflammatory factors<sup>1</sup>
- Risk factors: preexisting cognitive impairment (post stroke or depression), age, physical function, length of surgery, & type of surgery<sup>1</sup>

1. Rudolph JL, Marcantonio ER. Postoperative Delirium: Acute Change with Long-Term Implications. *Anesth Analg* 2011;112:1202–11.

2. Inouye SK, van Dyck CH, Alessi CA, Balkin S, Siegel AP, Horwitz RI. Clarifying confusion: the confusion assessment method—a new method for detection of delirium. *Ann Intern Med* 1990;113:941–8

# POSTOPERATIVE DELIRIUM

## ACUTE CHANGE WITH LONG-TERM IMPLICATIONS



Rudolph JL, Marcantonio ER. Postoperative Delirium: Acute change with long-term implications. *Anesth Analg.* 2011;112:1202-11.

# POSTOPERATIVE DELIRIUM

- Most common on Postop. day 1 and 2.
- Disturbance in attention, focus and interaction with the environment
- May include major violent actions, but mostly withdrawn attentiveness or inappropriate responses to environment
- Exclude CNS issues from infection or drug withdrawal
  
- 50% will resolve in two days, but one-third still having symptoms at discharge, and one-half of those still experience symptoms at one month post discharge

Marcantonio ER, Goldman L, Mangione CM, Ludwig LE, Muraca B, Haslauer CM, Donaldson MC et al. A clinical prediction rule for delirium after elective noncardiac surgery. *JAMA*. 1994;271:134–9.

# RISK FACTORS FOR POSTOPERATIVE DELIRIUM

Non-Cardiac Surgery	Points/Risk of Delirium
Cognitive impairment Telephone Interview for Cognitive Status (TICS) score <30)	0 pts= 1-2%
Age ≥ 70	1-2 pts= 8-19%
Physical function (Sedation-Agitation Scale (SAS) class IV)	≥ pts= 45- 55%
Alcohol abuse	
Na 130-150, K 3.0-6.0 mmol/L, Glu 60-300	
AAA (2 points)	
Non-cardiac thoracic surgery	

Marcantonio ER, Goldman L, Mangione CM, Ludwig LE, Muraca B, Haslauer CM, Donaldson MC et al. A clinical prediction rule for delirium after elective noncardiac surgery. *JAMA*. 1994;271:134-9.

# COMPLICATIONS FROM POD

- Increased LOS (Becker's review – costs: \$1791-2289/day)
- Increased ICU LOS or ICU readmission, higher inpatient mortality
- Patient falls/injuries
- Employee injuries
- Readmission
- Medicare penalties for readmission –new penalty in effect 10/1/16, up to 3% of Medicare reimbursement
- Higher rates of discharge to nursing homes

Rudolph JL, Marcantonio ER. Postoperative Delirium: Acute change with long-term implications. *Anesth Analg.* 2011;112:1202–11.

## COST OF LONG TERM CARE (LONGTERMCARE.GOV)

- Nursing Home Semi-private: \$205/Day \$6235/month
- Nursing home Private \$229/Day \$6965/month
- Assisted Living: \$3293/month
- For each person who requires long-term care from an acute hospitalization, the annual economic burden is \$75,000.

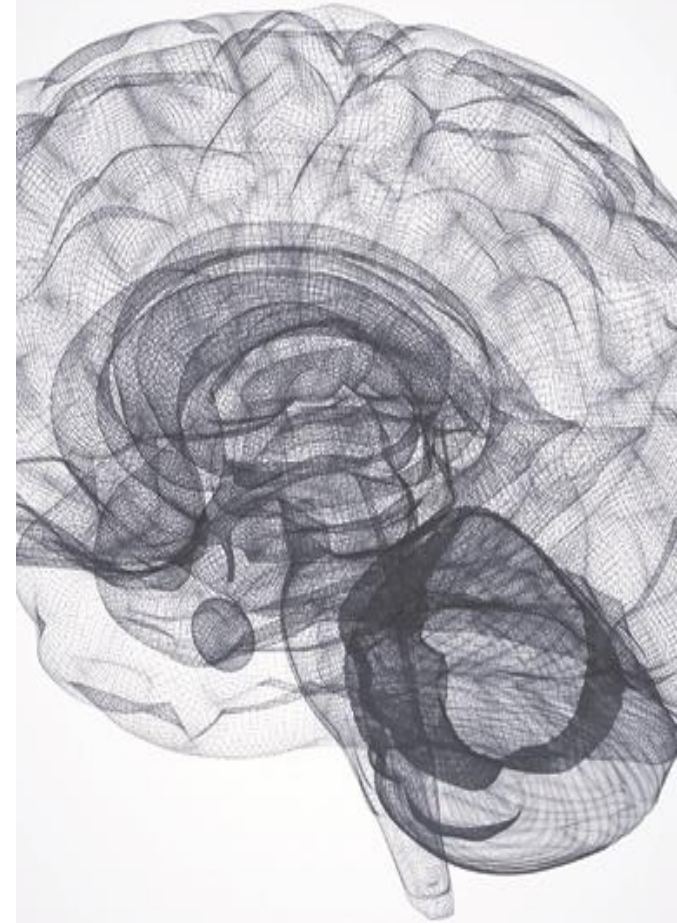
Age of Pop.	2000	2010	( <a href="http://www.census.gov">www.census.gov</a> )
▪ 65-74	18.3M	21.7M	
▪ 75-84	12.3M	13.0M	
▪ 85-94	3.9M	5.1M	
▪ 65+ in an SNF in 2010:	1.25M of 40.2M age 65+ (\$94 billion)		



# PREVENTING POSTOPERATIVE DELIRIUM

## Multifactorial intervention programs (MHELP):

- Orientation (clocks, calendars)
- Improve sensory input (glasses, hearing aids)
- Early mobilization
- Good pain & anesthesia management
- Avoid cognitively active meds
- Minimize polypharmacy
- Fluid/electrolyte management
- Adequate nutrition
- Bowel protocol
- Remove Foleys early
- CNS oxygen delivery: supplemental O<sub>2</sub> and transfusions



Rudolph JL, Marcantonio ER. Postoperative Delirium: Acute change with long-term implications. *Anesth Analg.* 2011;112:1202–11.

# PREVENTION

- Can POD be lessened?
- Monitoring depth of anesthesia in a randomized trial decreased the rate of POD ( $p < 0.05$ ), but only trended for POCD ( $p$  value 0.06)<sup>1</sup>
- BIS (bispectral Index) monitoring is a convenient tool to measure depth of anesthesia & permit dose adjustments for patients who may be too deep or too light during anesthesia.
- Easy to apply, and use in selective populations at risk for POD

Chan M, Cheng B, Lee, T, Gin, T. BIS-guided anesthesia decreases postoperative delirium and cognitive decline. *J Neurosurg Anesthesiol.* 2013;25:33–42.

# SEDATION DEPTH DURING SPINAL ANESTHESIA AND THE DEVELOPMENT OF POSTOPERATIVE DELIRIUM IN ELDERLY PATIENTS UNDERGOING HIP FRACTURE REPAIR<sup>1</sup>

Prospective, randomized, double-blind trial of ≥65 y/o for hip fx

114 patients

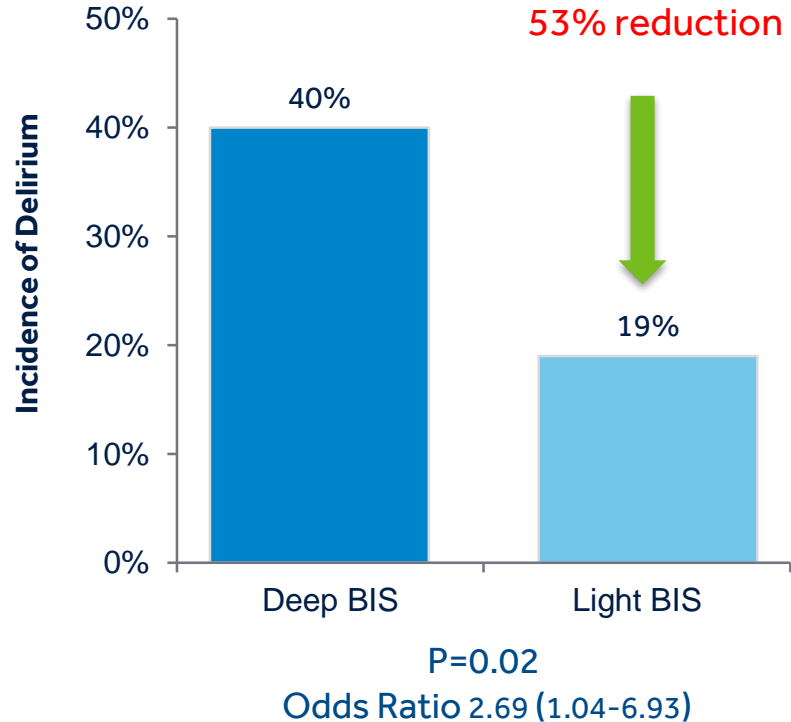
Screened out pre-op delirium, but allowed dementia deemed not severe (MMSE ≥15)

Protocol

- Midazolam allowed (up to 2mg) for SAB placement
- Propofol titrated to deep (BIS target 50) or light (BIS ≥80)

Assessed for delirium with CAM/MMSE

POD 2 → discharge



1. Sieber FE, Zakriya KJ, Gottschalk A, Blute MR, Lee HB, Rosenberg PB, Mears SC. Sedation depth during spinal anesthesia and the development of postoperative delirium in elderly patients undergoing hip fracture repair. *Mayo Clin Proc.* 2010; 85(1): 18-26.

# SEDATION DEPTH DURING SPINAL ANESTHESIA AND THE DEVELOPMENT OF POSTOPERATIVE DELIRIUM IN ELDERLY PATIENTS UNDERGOING HIP FRACTURE REPAIR<sup>1</sup>

More days of delirium per pt in deep group  
(1.4 vs 0.5 p=0.01)

For those with delirium, length not different  
(3.4 vs 2.8 NS)

NNT= 4.7

- Cost of five BIS probes around \$100
- Cost of one case of delirium \$2500 or more (extended LOS)
- Total propofol dose greater in deep group
  - Deep (10.2 mg/kg) vs Light (2.5 mg/kg) (p<0.001)
  - Propofol dose did not predict delirium
  - The patient's BIS (response to propofol) predicted delirium

1. Sieber FE, Zakriya KJ, Gottschalk A, Blute MR, Lee HB, Rosenberg PB, Mears SC. Sedation depth during spinal anesthesia and the development of postoperative delirium in elderly patients undergoing hip fracture repair. *Mayo Clin Proc.* 2010;85(1)18-26.

# BIS-GUIDED ANESTHESIA DECREASES POSTOPERATIVE DELIRIUM AND COGNITIVE DECLINE<sup>1</sup>

Delirium predicted POCD (related??)

BIS reduced anesthetic usage:

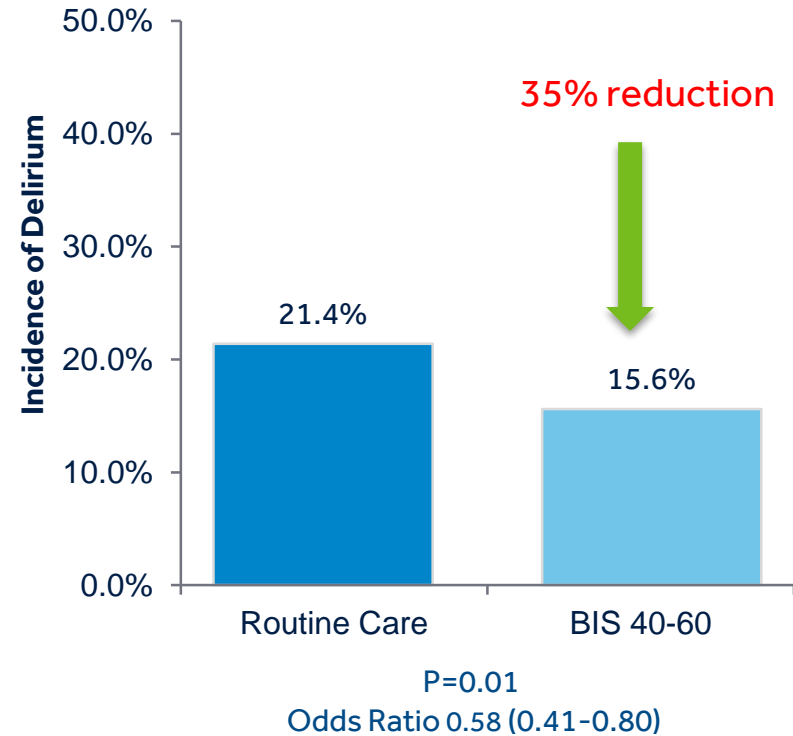
- Propofol 21% less
- Volatile 30% less

Faster emergence (4.3 minutes)

Shorter PACU stays (12.5 minutes)

Incidental finding

- BIS group had significantly fewer post op infections (p=0.01)



Chan M, Cheng B, Lee, T, Gin, T. BIS-guided anesthesia decreases postoperative delirium and cognitive decline. *J Neurosurg Anesthesiol.* 2013;25:33-42.

# DOES ANESTHESIA TYPE (REGIONAL VS GENERAL) MAKE A DIFFERENCE IN DELIRIUM?

## Maybe...

- 2004 Cochrane Review showed regional anesthesia was also associated with a reduced risk of acute postoperative confusion compared to general anesthesia<sup>1</sup>
  - 9.4% versus 19.2%<sup>1</sup>
  - RR 0.50, 95% CI 0.26 to 0.95<sup>1</sup>

## Maybe not...

- 2010 meta-analysis by Mason
- RA no benefit over GA for delirium<sup>2</sup>

1. Parker MJ, Handoll HH, Griffiths R. Anaesthesia for hip fracture surgery in adults. *Cochrane Database Syst. Rev.* 2004;(4):CD000521.

2. Mason SE, Noel-Storr A, Richie CW. The impact of general and regional anesthesia on the incidence of postoperative cognitive dysfunction and postoperative delirium: a systematic review with meta-analysis. *J Alzheimers Dis.* 2010;22 Suppl 3:67–79.

# WHAT REALLY HAPPENS DURING SEDATION

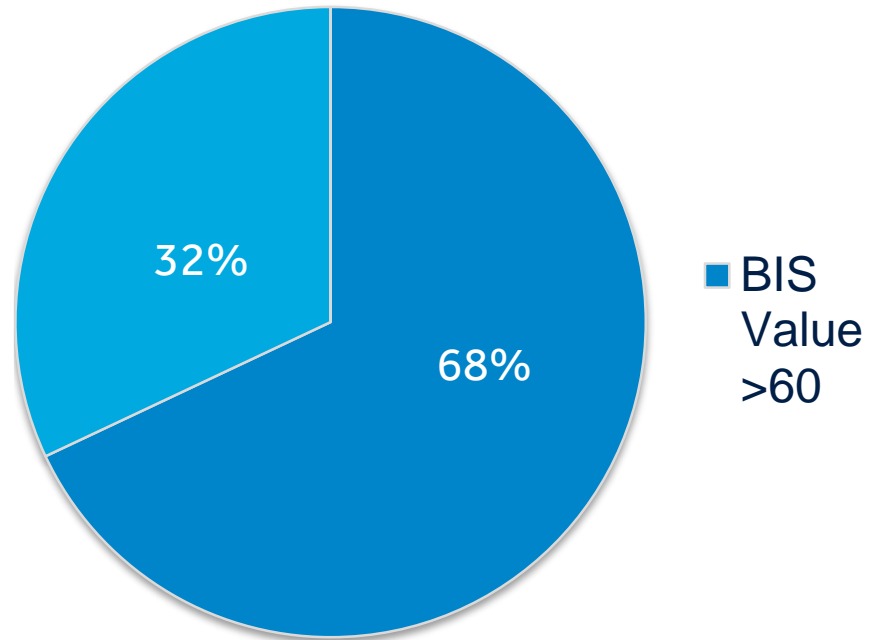
Patients  $\geq 65$  for hip fx repair

Spinal anesthesia plus propofol sedation

BIS data collected but providers were blinded

So, we more heavily sedate patients than we recognize – opportunity to reduce POD & POCD

TIME SPENT BIS  
<60



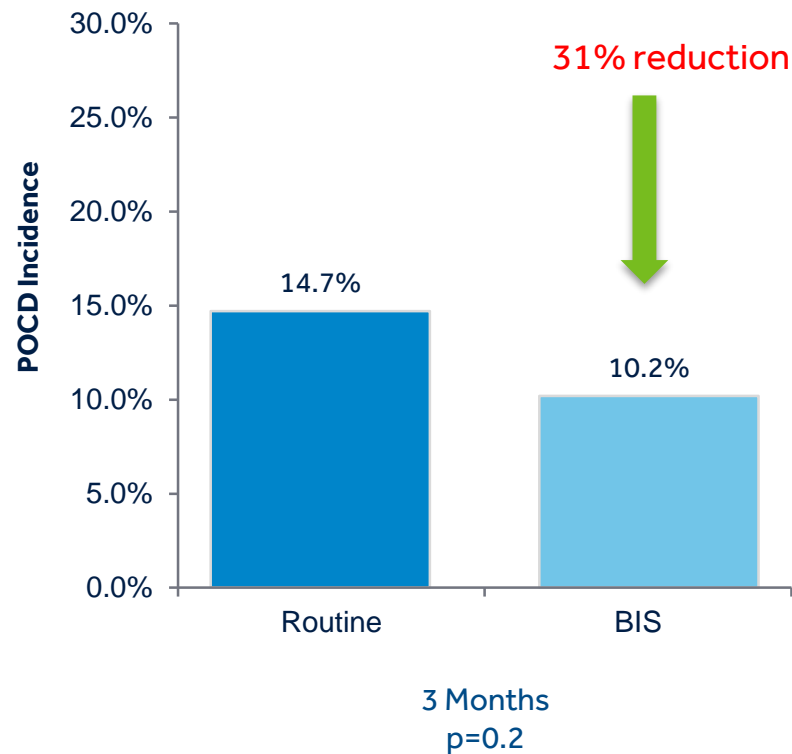
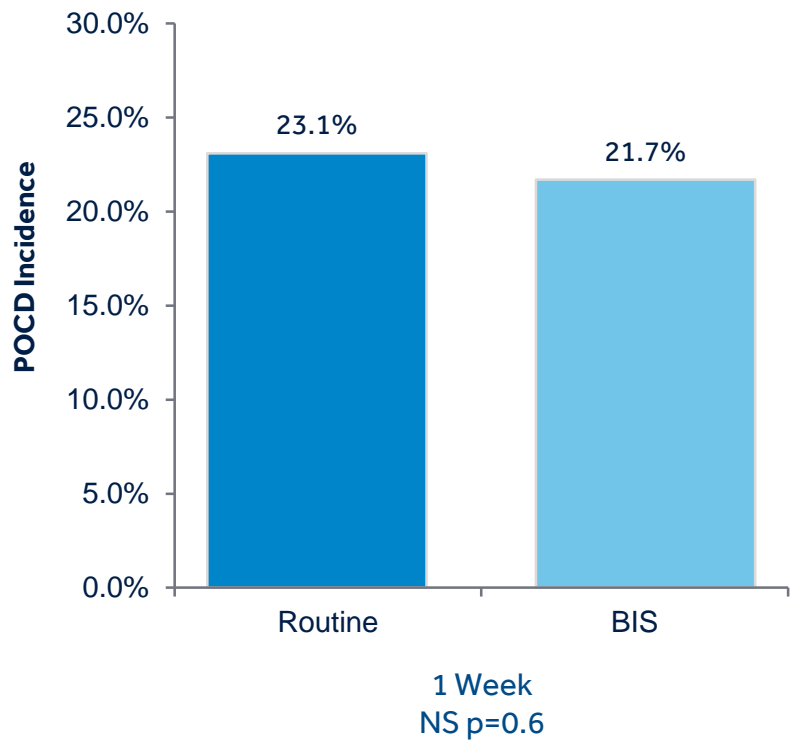
Sieber FE, Gottshalk A, Zakriya KJ, Mears SC, Lee H. General anesthesia occurs frequently in elderly patients during propofol-based sedation and spinal anesthesia. *Journal of Clinical Anesthesia.* (2010) 22, 179–183.

# INTERVENTION WITH BIS MONITORING

- Knowing that GA vs. RA + sedation should use BIS technology to reduce anesthetic use & reduce POD. Patient and surgeon satisfaction can be optimized with reduced postoperative complications, LOS and readmissions.
- Surgeons don't usually want patients asking questions during surgery, but patients don't want to experience the postoperative delirium or nausea associated with heavier sedation/general anesthesia



# INCIDENCE OF POCD: EFFECT OF BIS-GUIDED ANESTHETIC



Chan M, Cheng B, Lee, T, Gin, T. BIS-guided anesthesia decreases postoperative delirium and cognitive decline. *J Neurosurg Anesthesiol.* 2013;25:33–42.

# BIS-GUIDED ANESTHESIA DECREASES POSTOPERATIVE DELIRIUM AND COGNITIVE DECLINE<sup>1</sup>

“...for every 1000 patients undergoing major surgery, BIS-guided anesthesia prevented 83 patients from suffering delirium during hospital admission and 23 patients from POCD at 3 months after surgery.”<sup>1</sup>

\*40+M anesthetics in US annually would calculate to 3.3+M cases of POD,  
920+K POCD Patients

1. Chan M, Cheng B, Lee, T, Gin, T. BIS-guided anesthesia decreases postoperative delirium and cognitive decline. *J Neurosurg Anesthesiol.* 2013;25:33–42.

# MONITORING DEPTH OF ANESTHESIA IN A RANDOMIZED TRIAL DECREASES THE RATE OF POSTOPERATIVE DELIRIUM BUT NOT POSTOPERATIVE COGNITIVE DYSFUNCTION<sup>1</sup>

- Trend was for less POCD, but NS (0.06)
- Post-hoc analysis showed that although average BIS values were similar in the groups, the “routine care” patients had more episodes of BIS<20 and a higher average suppression of the EEG signal.
  - Authors propose that the reduction in delirium might be related to decreasing the amount of time spent at very low BIS with high levels of EEG suppression

1. Radtke FM, Franck M, Lendner J, Kruger S, Wernecke KD, Spies CD. Monitoring depth of anaesthesia in a randomized trial decreases the rate of postoperative delirium but not postoperative cognitive dysfunction. *British Journal of Anaesthesia*. 2012; 110 (S1): i98–i105.

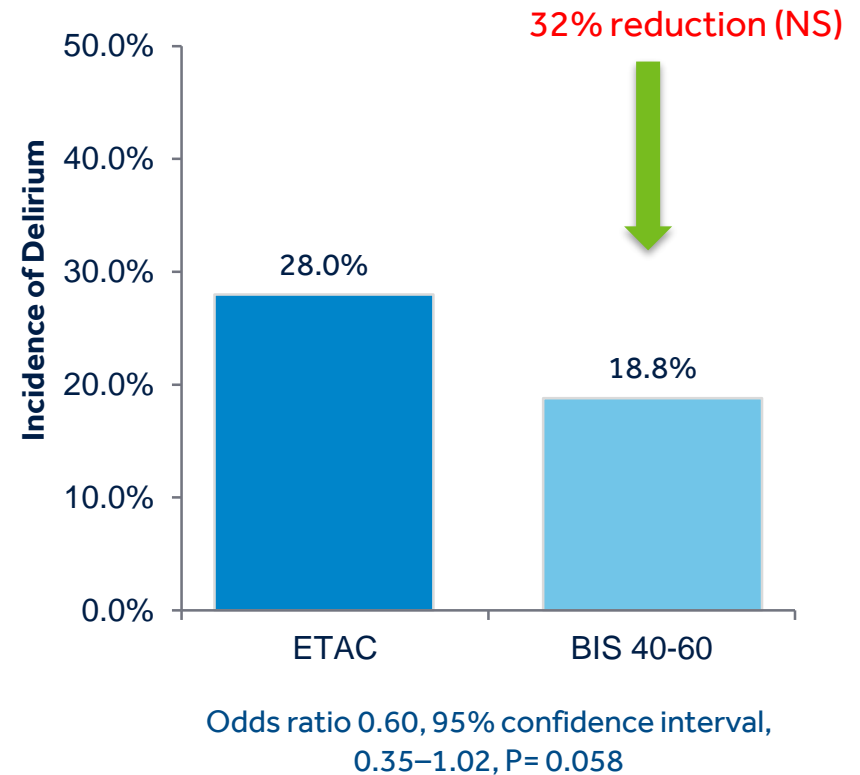
# POSTOPERATIVE DELIRIUM IN A SUBSTUDY OF CARDIOTHORACIC SURGICAL PATIENTS IN THE BAG-RECALL CLINICAL TRIAL<sup>1</sup>

310 cardiac or thoracic surgery pts who went to ICU post-op

Sub-analysis of BAG-RECALL study (awareness with recall)

- BIS group=Titrate to BIS<60
- ETAC=Keep end-tidal anesthetic concentration 0.7-1.3 (age adjusted)

Delirium assessments with CAM-ICU twice daily until ICU discharge or 10 days (whichever came first)



1. Whitlock E, Torres B, L, N, Helsten D, Nadelson M, Mashour G. Postoperative delirium in a substudy of cardiothoracic surgical patients in the BAG- RECALL clinical trial. *Anesth Analg*. 2014;118: 809-17.

# META-ANALYSIS OF THESE FOUR TRIALS

## PUTTING IT ALL TOGETHER

Study	Patient Population	Group 1 (n)	Group 2 (n)	Odds Ratio for delirium Group 1 v Group 2
Sieber et al. 2010	≥ 65, hip fx, SAB, propofol sedation	BIS ≥ 80 (57)	BIS ≈ 50 (57)	0.35 (0.15–0.82)
Chan et al. 2013	> 60yo, elective major noncardiac surgery	BIS-guided (450)	Routine care (452)	0.58 (0.41–0.80)
Radtke et al. 2013	> 60yo, elective major noncardiac surgery	BIS-guided (575)	Routine care (580)	0.73 (0.54–0.98)
Whitlock et al.	Elective cardiac and thoracic surgery	BIS-guided (149)	ETAC-guided (161)	0.60 (0.35–1.02)
Meta-analysis of the above studies		(1231)	(1250)	0.56 (0.42–0.73)

Whitlock E, Torres B, L, N, Helsten D, Nadelson M, Mashour G. Postoperative delirium in a substudy of cardiothoracic surgical patients in the BAG- RECALL clinical trial. *Anesth Analg*. 2014;118: 809–17.

# HOW TO EDUCATE STAFF TO INCREASE AWARENESS OF POD AND POCD?

- Surgical & Anesthesia Grand Rounds as a focus. This educates surgeons and anesthesiologists to align to reduce this complication
- All anesthesia providers (MD, CRNA, AA) renew education annually
- BIS-guided anesthesia administration can substantially reduce POD. Emphasize health benefits, cost savings and employee benefits (safety and long hours)
- Anesthesia leadership requires senior administrative leadership to affirm commitment to patient safety and prevention of complications. Resources must be available for optimum safe anesthetic care

## EXAMPLE

- Volatile anesthetic expense cost reduction initiative:
- Education - use 'low flow' rates following induction, or we will eliminate use of the most expensive volatile anesthetic. All MD, CRNA and residents involved
- Result: 5 year annual 50-60% cost reduction from annual expense of \$550K to \$240K sustained with 40,000 anesthetics per year.
- Leadership commitment essential

# SUMMARY

- Postoperative delirium & POCD may be reduced with BIS utilization with substantial short & long term savings
- Reduction in LOS, HAC, readmissions, Medicare penalties and hospital costs will result
- 40+ million anesthetics in the US per year
- Aging population who require more procedures
- Better understanding of contributors to postoperative outcomes
- BIS is FDA-approved for monitoring anesthetic depth & helps reduce anesthesia dosing & risk of inadequate anesthesia (awareness under anesthesia)



# SUMMARY

Postoperative delirium occurs at a high incidence, especially in the elderly

Many risk factors and precipitating factors

Anesthetic management – including targeting anesthetic or sedative effect - may have a significant impact on reducing the occurrence of post-operative delirium



***THANKS FOR YOUR INTEREST IN LEADING &  
PROMOTING PATIENT SAFETY!***

Time available for Q & A