

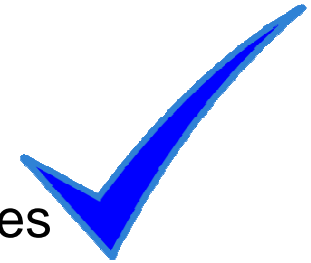


Pre-operative Screening: Early Identification of Patients at Risk for Delirium in Cardiac Surgery

Rima Styra MD, MEd, FRCPC
University of Toronto

Preoperative risk factors of POD in cardiac surgery

- **196 papers reviewed – 123 risk factors were identified**
- **Age:** significant across 47 independent studies
- **Cognitive impairment:** significant in 21 independent studies
- **Previous TIA/Stroke:** significant in 9 studies
- **Emotional/Personality traits (which included depression):** significant in 17 studies
- **Substance use (street drugs, alcohol, nicotine):** significant in 7 studies



Hollinger, J Cardiothoracic Vascular Anesthesia, 2015

Increasing age – 47 studies

Variable Method of Identification¹

1. **General cut-off point:** 65 years and older

2. **By decade:** ≥ 60 ² ≥ 65 ^{3,4} ≥ 70 ⁵

-14,000 patients - every decade of age starting 50 years old or older : 12%, 28% and then 40%. ⁶

3. **By year:** Meta-analysis of risk ratios found the risk rises 8% each year¹

1. Lin, J Car Surgery, 2012 2. Katznelson, Anesthesiol, 2009 3. Kazmierski, J Psychosom Res , 2010 4. Tse, Cardiothor Vasc Anes 2015 5 Koster, European J Cardiovascular Nursing 2013. 6. Bucerius, J Thorac Cardiovasc Surg 2004

Cognitive Impairment

Author	Odds Ratio	95% C.I.	P value
Banach 2004	10.2	3.7 to 28.6	p<0.0001
Kazmierski 2010	6.14	3.31 to 11.39	p<0.001
Schoen 2010	6.5	1.75 to 24.13	p=0.018
Koster 2013	4.5	1.6 to 12.7	p=0.004
Tse 2015	2.5	1.3 to 4.9	p=0.006

Banach, Med Sci Monitor, 2008; Kazmierski, J Psychosom Research 2010 ; Schoen, Critical Care 2010; Koster, Eur J Cardiovas Nurs 2013; Tse, J Cardiothor Vasc Anes 2015

Limitations of cognitive impairment research

- Measurement tools used were not consistent and in one case the instrument was not identified, nor the method of diagnosis
- MMSE cut off points for defining cognitive impairment **varied** throughout the studies
- Inclusion/exclusion of dementia patients from studies changes prevalence rate of impairment



Depression

- Few of the studies use scales
- Past history – chart review
- Self-report
- Odds ratios: 1.2⁷ to 6.3⁸

7. Rudolph, *Circulation*, 2009

8. Banach, *Med Sci Monitor*, 2008

Patient population

- UHN is a tertiary care hospital with 28 CVICU beds and 40 cardiac surgery beds
- Patients waiting for surgery were identified in the pre-operative clinic based on risk factors
- Some of the risk factors that were highlighted:
 - documented, self or family report of cognitive issues
 - history of cerebrovascular accident or TIA
 - psychiatric history
 - substance use
- Cardiac surgery patients were referred for preoperative psychiatric assessment which occurred at the time of the pre-operative assessment

Assessed variables

- Psychiatric diagnosis (based on a psychiatric assessment by a CL psychiatrist) using DSM IV TR/DSM 5 criteria
- MMSE scores pre-operatively for all patients
Cognitive impairment (defined as MMSE score of ≤ 24)
- Heavy alcohol use: (based on Canadian guidelines)
>10 drinks per week (female)
>15 drinks per week (male)
- Benzodiazepine use as per lorazepam equivalents
- Substance use disorder versus occasional use

Patient follow-up

- Psychiatrist followed up on patients seen pre-op within 24 - 48 hours of surgery (exception: patients who had surgery on Friday, followed up on the Monday)
- Nursing staff in the CVICU complete delirium rating scales NEECHAM originally and then hospital adopted the CAM-ICU and CAM on the floor completed once every shift
- **Three** sources of assessment for delirium – nursing, scales and psychiatrist

Methods

- 421 patients were originally assessed
- 26 patients not included (6 patients passed away during surgery or declined surgery; 20 patients did not complete the MMSE)
- Patients were seen prospectively with retrospective chart review of 395 preoperative psychiatric consultation records and post-operative notes of patients

Proportion of sample assessed by delirium tool

Tool	Sample size	Percentage (%)
NEECHAM	176	44.6%
CAM	219	55.4%

Prevalence of risk factors by gender

Overall delirium rate: 26.1%

Total N=395	Males N = 227 (57.7%)	Females N = 168 (42.5 %)
Delirium	57 (25.1%)	46 (27.4%)
History of CVA/TIA	75 (33%)	52 (31%)
Heavy users of alcohol	13 (5.7%)	14 (8.3%)
Currently uses substances	7 (3.1%)	5 (3%)
Current depression	40 (17.6%)	51 (30.4%)

Prevalence of delirium by cardiac surgery type

Surgery Type	Non-Delirious N=292	Delirious N=103	OR (95% CI)	P value
ACB	99 (22.9%)	31 (30%)	0.84 (0.52-1.36)	P=0.48
ACB + Valve	24 (8.2%)	19 (18.4%)	2.52 (1.32-4.84)	P=0.02
Valve	150 (41.3%)	51 (49.5%)	1.08 (0.69-1.69)	P=0.74

Results

Variable	Non-Delirious N=292 (%)	Delirious N=103 (%)	OR (95% CI)	P value
Mean Age (years)	65.4	73.1	n/a	*p<0.0001
Cohort				
80-89 years	44 (15%)	35 (34.3%)	2.96 (1.76-4.97)	*p<0.0001
70-79 years	81 (27.6%)	33 (32.3%)	1.25 (0.77-2.04)	p=0.38
60-69 years	78 (26.7%)	24 (23.3%)	0.83 (0.49-1.41)	p= 0.48
50-59 years	56 (19.1%)	10 (9.8%)	0.46 (0.23-0.94)	p=0.014

Results

Variable	Non-Delirious N=292 (%)	Delirious N=103 (%)	OR (95% CI)	P value
Mean MMSE score (Range)	26.9 (14-30)	25.7 (17-30)	n/a	*p=0.0005
MMSE ≤ 24	52 (17.8%)	33 (32%)	2.18 (1.31-2.63)	*p=0.006
Depression	32 (10.9%)	9 (8.8%)	0.79 (0.36-1.72)	p=0.533
CVA/TIA	89 (30.1%)	38 (37.3%)	1.36 (0.84-2.18)	p=0.213
Heavy alcohol use	22 (7.5%)	5 (4.7%)	0.63 (0.23-1.7)	p=0.33

Other Psychiatric Disorders

- Patients with anxiety diagnosis :
 - panic disorder 4%
 - generalized anxiety disorder 3%
- Anxiety diagnosis ($p=0.241$) was nonsignificant as a risk factor for delirium
- Schizophrenia numbers too low

Risk Factor Results

Variable	OR (95% CI)	P value
Age \geq 65 years	3.79 (2.05-7.03)	$p < 0.0001$
High benzodiazepine use (>2 mg lorazepam equiv)	3.56 (1.37-9.27)	$p = 0.009$
Previous delirium	2.71 (1.25-5.91)	$p = 0.012$
Cognitive impairment	2.49 (1.30-4.77)	$p = 0.006$

Independent OR comparison

Citation/Author	Age ≥ 65 (95% CI)	Previous delirium	Cognitive impairment
Tse 2015	3.0 (2.0-4.6)	7.7 (2.8-20.8)	2.5 (1.3-4.9)
Kazmierski 2010	4.23 (2.24-7.96)	N/A	6.14 (3.31-11.39)
Koster 2013	N/A	5.5*** (0.8-36.4)	4.5 (1.6-12.7)
Styra 2016	3.79 (2.05-7.03)	2.71 (1.25-5.91)	2.49 (1.30-4.77)

***p=0.07

Tse, J Cardiothoracic Vascular Anesthesia 2015
Kazmierski, J Psychosomatic Research 2010
Koster, European J Cardiovascular Nursing 2013

Over-representation of CVA/TIA

Citation/Author	Delirium %	Non Delirium %	CVA/N sample	CVA/N sample %
Tse 2015	24	10	34/679	5
Kazmierski 2010	10.87	5.1	33/563	5.8
Bucerius 2004	8.5	3.2	589/16,184	3.6
Koster 2013	23	9.2	35/300	11.7
Guenther 2013	4.4	0	3/215	1.4
Katznelson 2009	15.6	8.6	100/1059	9.4
Styra 2016	34.1	31.6	129/395	32.2

Tse, J Cardiothoracic Vascular Anesthesia 2015
Kazmierski, J Psychosomatic Research 2010
Bucerius, J Thoracic Cardiovascular Surgery 2004
Koster, European J Cardiovascular Nursing 2013
Guenther, Annals Surgery 2013
Katznelson, Anesthesiology, 2009

Heavy alcohol and substance use

- History of heavy alcohol use by males and females ($p=0.207$) was not significant, as was street drug use
- 82% - the majority of heavy alcohol users did not develop delirium
- This may be due to:
 - younger mean average age of 51.3 years
 - lower percentage of cognitive impairment (12%)
- Early identification of this issue and proper treatment initiated post-operatively (CIWA)
- Substance use (street drugs and/or alcohol) comorbidity with current or past history of psychiatric disorders was not significant

Limitations

Cardiac database was based on patients who were referred for psychiatric consultations and as such had larger numbers of patients with mental illness and neurological complications



Conclusions

- Age, cognitive impairment, high use of benzodiazepines, previous delirium were found as the most significant preoperative indicators. This is consistent with other studies
- Even among high risk patients with high prevalence of depression and history of CVA/TIA, age and cognitive impairment continue to be the two consistent risk factors.
- Cognitive screening among older patients would provide a signal for concern

Conclusions (continued)

- Results of prediction would be improved by more extensive and specific cognitive testing
- Preoperative screening for risk merits routine inclusion in pathways of care for cardiac patients
- A focus on modifiable factors is important
- Highly complicated preventive strategies likely to fail



Acknowledgements

- Elisabeth Larsen
- Nizanthan Rathitharan





References

- Banach, M., Kazmierski J., Kowman, M., Okonski, P., Sobow, T., Kloszewska, I., ...Jaszewski, R. (2008). Atrial fibrillation as a nonpsychiatric predictor of delirium after cardiac surgery: A pilot study. *Medical Science Monitor*, 14(5) 286-291.
- Bucerius, J., Gummert J. F., Borger, M. A, Walther, T., Doll, N., Falk, V., ...Mohr, F. W. (2004). Predictors of delirium after cardiac surgery delirium: effect of beating-heart (off-pump) surgery. *The Journal of Thoracic and Cardiovascular Surgery*, 127(1) 57-64.
- Guenther, U., Theuerkauf, N., Frommann, I., Brimmers, K., Malik, R., Stori, S., ... Popp, J. (2013). Predisposing and precipitating factors of delirium after cardiac surgery. *Annals of Surgery*, 257, 1160-1167.
- Hollinger, A., Siegemund, M., Goettel, N., Steiner, L. A. (2015). Postoperative delirium in cardiac surgery: An unavoidable menace? *Journal of Cardiothoracic and Vascular Anesthesia*, 29(6) 1677-1687. <http://dx.doi.org/10.1053/j.jvca.2014.08.021>
- Inouye, S.K., van Dyck C. H., Alessi, C. A., Balkin, S., Siegal, A. P., Horwitz, R. I. (1990). Clarifying confusion: the Confusion Assessment Method. *Annals of Internal Medicine*, 113(12), 941-948.
- Katznelson, R., Djaiani, G. N., Borger, M. A., Friedman, Z., Abbey, S. E., Fedorko, L.,... Beattie, W. S. (2009). Preoperative use of statins is associated with reduced early delirium rates after cardiac surgery. *Anesthesiology*, 110, 67-73.
- Kazmierski, J., Kowman, M., Banach, M., Fendler, W., Okonski, P., Banys, A,...Kloszewska, I. (2010). Incidence and predictors of delirium after cardiac surgery: Results from the IPDACS study. *Journal of Psychosomatic research*, 69, 179-185.

References (continued)

- Koster, S., Hensens, A. G., Schuurmans, M. J., van der Palen, J. (2011). Risk factors of delirium after cardiac surgery: a systematic review. *European Journal of Cardiovascular Nursing*, 10, 197–204. <http://dx.doi.org/10.1016/j.ejcnurse.2010.09.001>
- Lin, Y., Chen, J., Wang, Z. (2012). Meta-analysis of factors which influence delirium following cardiac surgery. *Journal of Cardiac Surgery*, 27, 481-492. <http://dx.doi.org/10.1111/j.1540-8191.2012.01472.x>
- Schoen, J., Meyerrose, J., Paarmann, H., Heringlake, M., Hueppe, M., Berger, K-U. (2010). Preoperative regional cerebral oxygen saturation is a predictor of postoperative delirium in on-pump cardiac surgery patients: a prospective observational trial. *Critical Care*, 15:R218 <http://dx.doi.org/10.1186/cc10454>
- Tse, L, Schwarz, S. K. W., Bowering, J. B., Moore, R. L., Barr, A. M. (2015). Incidence of and risk factors for delirium after cardiac surgery at a quaternary care center: a retrospective cohort study. *Journal of Cardiothoracic and Vascular Anesthesia*, 29(6), 1472-1479 <http://dx.doi.org/10.1053/j.jvca.2015.06.018>

Preoperative risk factors of POD in cardiac surgery

- Meta-analysis of **9** studies between 2008-2011

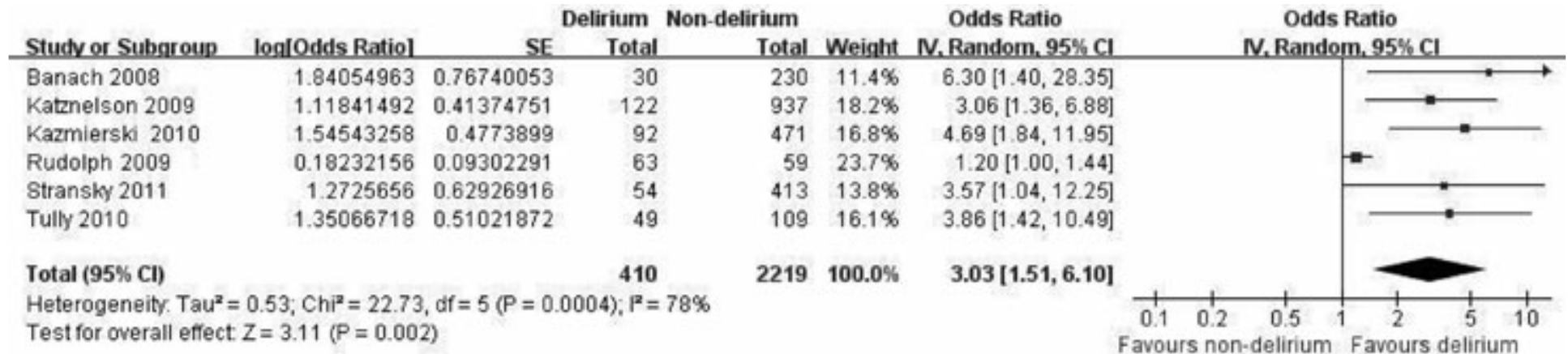
Following variables were significant:

- Age:
 - every year(four studies)
 - by decade (two studies)
 - 65 years and older (three studies)
- History of CVA(four studies)
- Depression (six studies)

Lin, J Cardiac Surgery, 2012



Independent Odds Ratio for Depression



Prevalence of Depression

Delirium (N=190)	Non-delirium (N=489)	P value
27% (14)	30% (6)	P=.0.001

Odds ratio **3.3** [95% CI: 1.8–6.1] p<0.001 , falling in the range of Lin 2012’s results

Tse, J Cardiothoracic Vascular Anesthesia 2015

Delirium risk related to drugs and alcohol

- Hollinger 2015's systematic review of 132 papers did not find any risk factors associated with alcohol
- Chang 2008: combined prolonged drug abuse with psychological disorders such as depression, significant only at univariate level, not multivariate level
- Koster 2013: Heavy alcohol use raised risk by **10.8**, with a 95% CI: **2.2-53.6**, $p=0.003$

Hollinger, J Cardiothoracic Vascular Anesthesia, 2015

Chang, American J Critical Care, 2008

Koster, European J Cardiovascular Nursing 2013