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POST-OPERATIVE DELIRIUM: A PREDICTIVE TOOL

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Background: Delirium or acute confusion is characterized by a disturbance in consciousness and change in cognition that develops over a short period of time and tends to fluctuate over the course of the day. It is a medical emergency that contributes significantly to increased morbidity and mortality, as well as longer and costlier hospitalizations and nursing home placement.

Method: After identifying variables from the literature, a group of interdisciplinary team members at a regional teaching hospital developed a predictive tool for post-operative delirium. The components of the tool included age, presence of dementia, alcohol consumption, burden of comorbidity and depression. The tool was tested using a sample of 60 general surgery and orthopedic patients undergoing elective surgery. Patients were randomized to receive or not to receive the tool pre-operatively. All 60 patients were assessed post-operatively for evidence of delirium using the Confusion Assessment Method (CAM) and consultation with a Geriatrician.

Results: All 30 patients who had the tool administered scored ≤8, and one showed evidence of delirium post-operatively with the use of the CAM. Two patients in the control group showed evidence of delirium on post-operative day 2 and 4 respectively, as identified by the CAM.

Conclusion: All the patients who did not develop delirium by CAM assessment scored in the low risk category on the tool. Consequently, validity of the tool could not be determined since none of the patients scored in the high risk category. The group will continue to test validity of the tool so that it may become part of the comprehensive pre-operative assessment process for patients undergoing surgery.

Key words: Post-operative delirium, delirium, predictive tool, surgery, elderly

INTRODUCTION

Delirium or acute confusion is a prevalent phenomenon in hospitalized elderly, both on medical and surgical units. It is "characterized by a disturbance in consciousness and change in cognition that develops over a short period of time and tends to fluctuate over the course of the day".[1] It is also described as a medical emergency which contributes significantly to increased morbidity and mortality.[2] Statistics demonstrate that prevalence ranges from 10-40% in general hospitalized elderly patients, and is more staggering in the post-operative population with a prevalence of up to 60%.[3] Equally staggering are the numerous studies which have consistently demonstrated that delirium independently contributes to poorer outcomes, specifically greater morbidity, longer and costlier hospitalizations, nursing home placements and even death.[3]

The impetus to address this devastating phenomenon stems from two significant cases on the orthopedic ward. In both instances, the patients suffered a decline in their level of functioning following surgery, which in the first case necessitated institutionalization, and in the second case, the patient took 6 months to return to his home. In both circumstances, the family members expressed anger and frustration at the lack of information made available to them regarding the possibility of developing delirium. The patients' family members also verbalized that if they had prior knowledge of the deleterious effects of delirium during the post-operative course, they likely would have discouraged their loved ones from proceeding with surgery.

As a result of these experiences, an interdisciplinary team was formed in 1998 to further investigate this phenomenon by attempting to develop and validate a tool to predict the occurrence of delirium in the post-operative phase.

METHODS

Literature Review

Medline and CINAHL searches were conducted using the following keywords: delirium, post-operative delirium, delirium screening tools, predictive tools, delirium assessment tools and identification

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of post-operative delirium. Over 35 articles were reviewed that met the criteria or area of interest. Of the literature reviewed, none contained a tool that the team felt could be used for predicting pre-operatively the likelihood of patients developing delirium post-operatively.

Predictive Tool Development and Patient Material

The tool contained five risk factors extrapolated from the literature, which were identified as significant contributors for the development of post-operative delirium. They were age,[4] presence of dementia, alcohol consumption, burden of co-morbidity and depression[5] (Table 1). A score of 1 was assigned if the patient was over the age of 65. Several studies found that patients with age >65 were more likely to develop delirium post-operatively.[4,5] The Mini-Mental State Examination (MMSE)[6] as well at the clock drawing[7] are validated tools that were used to measure the presence of dementia. A score of 2 was assigned for severe impairment or abnormal clock drawing. The CAGE[8] was used to measure alcohol consumption. It consists of four questions that pertain to the use and response to alcohol consumption. One study[8] found that patients who answered *yes* to any two questions were more likely to develop delirium post-operatively. Burden of comorbidity pertaining to respiratory, renal, liver, cardiac, endocrine and psychiatric illnesses[5] was evaluated and assigned a score of 1 to 3, depending on the number of illnesses that were present. Depression was assessed using the short-form of the Geriatric Depression Scale (GDS).[9,10] A total score ≤6 on the predictive tool was considered low risk for developing delirium and a score ≥13 was considered high risk. Members of the team determined the scoring based on clinical experience.

The sample consisted of 60 general surgery and orthopedic patients scheduled for elective surgery. Patients >50 years old who could read and write English with an expected length of stay (LOS) >48 hours were included in the study. Patients who could not participate in the interview process, or had an expected LOS of <48 hours, or had a malignant neoplastic or terminal disease were excluded from the study. The study was performed at a Regional Community teaching hospital in the Greater Toronto Area. Patients were approached for participation in the study between January 2000 and

Table 1. Predictive Tool for Post-operative Delirium

Name:_____ **MRN:**_____
Type of Surgery:_____
Surgeon:_____

1. Age >65 years **(1)** <65 years **(0)**

2. Presence of Cognitive Function Impairment

a) Folstein Mini-Mental State Exam

(Assign points as indicated after each level of impairment)

No impairment (>24/30)	(0)
Moderate impairment (18-23/30)	(1)
Severe impairment (0-17/30)	(2)

b) Clock Drawing Test

(Adopted from Sunderland et al 1989[7] & Wolfe-Klein et al)

A score of 6 or less constitutes an abnormally drawn clock – **give 2 points**

Scoring:

10 Hands and numbers are all present and in the correct positions. Corrections without prompting are accepted as normal.
9 There are slight errors in the placement of hands or 1 missing number without spacing errors.
8 There are moderate errors in placement of hands, confusion as to small and large hands, or spacing errors alone.
7 The placement of hands is significantly off course or spacing is inappropriate.
6 Clock hands are used inappropriately or there is use of digital display, circling of numbers, or persevering in the writing or numbers.
5 Numbers are crowded to one end of the clock, reversed in order, or absent.
4 There is further distortion of the number sequence, counterclockwise order, many missing numbers, or numbers placed outside of the clock face border.
3 The numbers and closk face are no longer connected in the drawing.
2 Only vague representation of a clock or irrelevant spatial representation exist.
1 The result is uninterpretable or no attempt is made.

3. Alcohol Consumption

CAGE – allot 2 points if the patient answers YES to any 2 questions

- Have you ever felt you ought to Cut down on your drinking or drug use?
- Have you felt Annoyed about others criticizing your drinking or drug use?
- Have you felt Guitly about your drinking or drug abuse?
- Have you ever used alcohol or other drugs as Eye openers (i.e. to overcome a hangover or to get the day started?)

(Buchsbaum et al 1992[8])

4. Burden of co-morbidity

Co-morbidities:
a) Respiratory
b) Renal
c) Liver
d) Cardiac
e) Endocrine
f) Psychiatric

Allot the following points:

1 or 2/6 **(1)**
3 or 4/6 **(2)**
5 or 6/6 **(3)**

(Pompei et al 1994[5])

5. Depression

	Yes	No
Are you depressed?	1	0
Are you basically satisfied with life?	0	1
Do you feel that your life is empty?	1	0
Are you afraid that something bad is going to happen to you?	1	0
Do you feel happy most of the time?	0	1

(Mahoney et al 1994)[5]

Total Score obtained:_____
Risk Level:_____
Patient is considered high risk if score = 18-13, moderate risk if score = 12-7 and low risk if score = 6-1.

April 2000. The Hospital Research Ethics Board provided approval for the study; informed consents were obtained from all patients who volunteered to participate at the time of their Preadmission Visit. Once the patients gave informed consent to participate in the study, they were randomized into one of two groups – group I, tool administered; group II, tool not administered (control group). The control group was designed to measure potential impact of the tool administration to patients' future outcome. Randomization was achieved with the use of a computer generated random numbers list.

The tool was administered by an Occupational Therapist who had extensive knowledge and expertise in cognitive assessment. All 60 patients who entered the study were assessed post-operatively for evidence of delirium using the Confusion Assessment Method (CAM)[11] and consult by a Geriatrician. The CAM was administered on days 2, 4, and 6 post-operatively by the case managers or registered nurses on the units who were trained to use the CAM. The CAM is a standardized instrument, derived from the DSM-III-R criteria, which has proven useful in identifying patients with delirium.[11] The "gold standard" approach for diagnosing the presence of delirium was utilized by having a Geriatrician follow-up all patients between post-operative days 1 and 6,[4] because one report found that delirium was most likely to occur between post-operative days 1 and 6.[12]

The data was analyzed using SAS. Sensitivity and specificity of the tool were designed to measure function of the tool. The relative risk of administering the tool to patients' outcome was analyzed based on rates of delirium in the two groups.

RESULTS

Fifty-eight patients completed the study. We were unable to collect data on two patients – one in the observation group and one in the control group. An analysis demonstrated that the patients in both groups, observation and control were similar in age ($p>0.05$), gender ($p>0.05$) and length of stay ($p>0.05$) (Table 2).

Of the 29 patients who received the tool pre-operatively, all scored ≤8. Since ≤6 was randomly classed as low risk, the two patients who scored 7 and 8 respectively were considered moderate risk, and neither developed delirium post-operatively. However, one patient who scored 6 on the tool developed delirium. Figure 1 shows the score distribution of the patients in the observation group. Two patients in the control group showed evidence of delirium as per CAM assessment on post-operative day 2 and day 4. In both cases, the delirium resolved before consult with the Geriatrician. In an analysis of impact for the tool observation to delirium as per CAM assessment, the relative risk was 0.50 (95%CI: 0.05-5.22).

Table 2. Characteristics of the Study Groups

	Observation group	Control group
n	29	29
age (mean)	69.69	66.00
gender:		
male	17	14
female	12	15
LOS (mean)	7.08	5.59
total score by tool (mean)	3.03	–
Delirium by CAM	1	2

DISCUSSION

A study was undertaken by members of the interdisciplinary team to develop and validate a tool to assist health professionals pre-operatively to determind the likelihood of elective surgical patients developing delirium post-operatively. The tool contained five risk factors which had been identified-from the literature, as significant contributors to the development of post-operative delirium. In one prospective cohort study,[5] the authors had found that cognitive impairment, co-morbidity, alcohol consumption, and depression were significant contributors to delirium in hospitalized elderly patients.

Since most participants in the observation group scored low on the predictive tool (two scored in the moderate range), we were unable to determine reli-

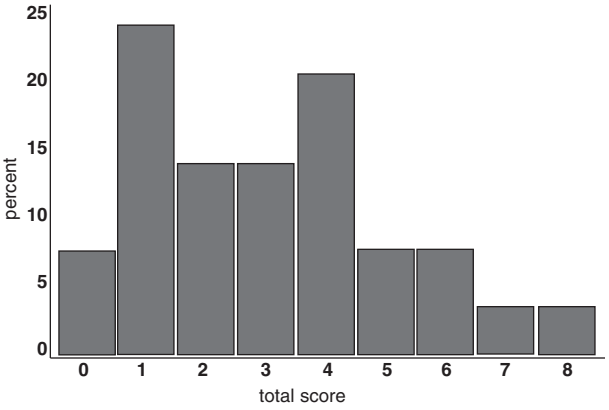

Figure 1. Distribution graph for total scores on predictive tool (n=29).

ability or validity of the tool. Weighting of each predictive component was questionable in terms of supporting the risk of developing delirium, e.g. a score of 2 for the presence of dementia. The one patient who showed evidence of delirium in the observation group had a score of 6 on the tool; however, he did score moderate impairment on the MMSE. A question that we are considering is whether the raw number is the correct method of scoring the tool, or should certain factors receive a heavier weighting, e.g. presence of dementia.

The relative risk of 0.50 (95%CI: 0.05-5.22) indicates that there is inconclusive evidence of the impact of administering the tool to later development of delirium detected with the given sample.

Some of the challenges faced during the study included: timing of the study; characteristics of volunteers versus non-volunteers; workload; CAM assessment; and Geriatrician "gold standard" assessment. The study occurred during the last quarter of the fiscal year, when resources and surgery time were limited. Consequently, the workload was tremendous for all participants in the study, including the Geriatrician who unfortunately was unable to assess all the patients.

Other limitations of the study include small sample size, community hospital, age of participants, and the lack of a standardized measure for comorbidity such as the Charlson Comorbidity Index.[13]

CONCLUSION

Although validity and reliability of the predictive tool were not determined, the following positive outcomes were observed: heightened awareness of post-operative delirium among interdisciplinary staff; increased physician knowledge, increased vigilance in monitoring for post-operative delirium; early identification, intervention and treatment of delirium by health-care professionals; and increased geriatric consultations for patients with delirium. The team had an interesting observation – one of the orthopedic surgeons asked for a consultation by the Geriatric Clinical Nurse Specialist for pre-operative risk assessment and post-operative follow-up.

Next Steps

The next steps include: exploring the use of the Charlson Comorbitidy Index[13] as a measure of comorbitidy; conducting an extension of the study to further validate the tool using a larger sample; implement the predictive tool as part of routine pre-operative screening; developing an intervention program for managing and minimizing the effects of post-operative delirium; and sharing this work through presentation and publication.

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