

## THE MULTI COMPONENT INTERVENTION TO PREVENT POSTOPERATIVE DELIRIUM AFTER OPEN-HEART SURGERY

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### ABSTRACT

**Objective:** To assess a multi-component intervention to prevent post operative delirium after open-heart surgery.

**Method:** This is an experimental-analytic study which assessed 32 patients 45 to 70 years of age after open-heart surgery in to 16 member groups (case and control). From second days after operation until three days later, by 6 risk factors: cognitive, visual and auditory impairment, immobility, dehydration and sleep deprivation were assessed and a standard protocol was used for case group. Incidence of delirium was determined by clinical interview; based on DSM-IV-TR; twice a day (morning and evening). Result were analyzed by t-test and S- plus.

**Results:** The median of total number of risk factors and immobility in case group had a significant reduction in comparison to control group. There were trends towards reduction in other risk factors and incidence of delirium.

**Conclusion:** Primary prevention of delirium is probably the most effective treatment strategy.

**KEY WORDS:** Risk factors Delirium, Preventive strategies, Open-heart surgery.

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### INTRODUCTION

Delirium is a syndrome which has multiple causes and all of them cause a similar pattern of symptoms related to alternating of consciousness and cognitive impairment. Classically delirium has an abrupt onset and a short fluctuating course. When causes are present, remission is rapid.<sup>1</sup>

The incidence of delirium makes prognosis poor and leads to a high mortality rate. On the other hand, it results in increased cost of care. Duration of hospitalization and latency of mobility in post operative patients. Unfortunately, delirium is misdiagnosed by physicians and health care providers.<sup>2</sup> Some causes of delirium include infections, electrolyte imbalances, substance withdrawal and endocrine impairments. Some famous hypotheses that describe delirium are neuron-chemical impairment, inflammatory alternations, oxidative stresses, blood brain barrier dysfunction and interaction between them.<sup>2</sup>

Prevalence of delirium is 1% in the general population, 10% in emergency settings and approximately 50% in patient settings. Incidence of delirium is 3-40% in medical settings and 15 to 25% in I.C.U and overall it is more common in surgical settings than medical settings. In cardiac surgery, incidence has been reported to range from 7 to 40%.<sup>2</sup>

Some risk factors consist of visual impairment, cognitive impairment, age more than 70

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years, comorbid medical diseases, physical restriction, malnutrition, use of more than three drugs simultaneously and use of Benzodiazepines as a sedative before operation.<sup>2</sup>

Other risk factors in postoperative open-heart surgery patients also include history of stroke and bruit in carotid. The most important risk factor related to the operation is duration of being under bypass pump.<sup>2</sup> Different studies also note psychiatric problems, using high doses of isotropic drugs and blood products as risk factors.<sup>3</sup> Different interventions have been used to prevent delirium and recognize risk factors. Educative protocols which focused on patient and family could significantly decrease some of the symptoms of delirium like disorientation, psychiatric signs and sleep disturbance.<sup>4,5</sup>

In postoperative fractured hip patients, protocols of orientation, sensory aids and education to patients significantly decreased symptoms of delirium.<sup>6</sup> Use of some protocols like nursing education, modulation environment, medical assessment, mobility and help with transportation of the patient could not significantly decrease incidence of delirium.<sup>7,8</sup> Use of hospitalized Elder Life Program (HELP) which has focused on six main risk factors of delirium caused a significant decrease in incidence of delirium and a number of other risk factors.<sup>9</sup> This included cognitive, visual and auditory impairments, immobility, sleep disturbance and dehydration. This study was conducted to plan a preventive program for delirium in postoperative open-heart surgery patients.

## PATIENTS AND METHODS

This is a case-control randomized study which assessed 32 patients 45 to 70 years of age after open heart surgery in Golestan Hospital in Ahwaz in Islamic Republic of Iran. Sixteen patients between 45 to 70 years of age were enrolled in the study which formed the case group. Delirium was ruled out in all of them at first by using a clinical interview Mini Mental Status Examination (MMSE) and Confusional Assessment Method (CAM) after the

operation. Risk factors including cognitive, auditory and visual impairments, dehydration and immobility were detected by standard tests. All the patients were supposed to have sleep disturbance as a risk factor. MMSE is a quantitative tool for assessing cognitive function and its score is from 0 to 10 in orientation and 0 to 30 totals. Score less than eight in orientation or less than 20 total, means cognitive impairment.<sup>1</sup> CAM is used to detect delirium too. If there are abrupt onsets, fluctuating course and attention impairment plus one of the two following disorders; disorganized thought or altered consciousness; it confirm onset of delirium.<sup>11</sup>

Tests which were used to detect risk factors included:

1. Katz Activity Daily Living which used to detect immobility and assessed seven basic caring skills consisting of eating, bathing, toilet, and grooming, dressing, ability to move between bed and chair and walking. Its score is from 0 to 14 and a score less than twelve is equal to impairment.<sup>12</sup>
2. Whisper test is used to detect auditory impairment. The physician conducting the test stands behind the patient at a distance of 15 cm and whispers twelve words one by one and patient repeats them. Its score is from 0 to 12 and a score less than six is equivalent to impairment.<sup>13</sup>
3. MMSE as noted previously assesses cognitive function.<sup>10</sup>
4. Standard Jaeger test assesses binocular vision and its score is from 20/20 to 20/80 and score less than 20/70 means impairment.<sup>14</sup>
5. Ratio of Blood Urea Nitrogen (BUN) to Creatinine in serum is used to assess dehydration and if this ratio was equal or greater than 18 then that patient is considered dehydrated.<sup>9</sup> Then until the end of 5<sup>th</sup> post operative day, this group was interviewed twice a day to detect probable delirium and since that the most probable time of delirium is in this period.<sup>9</sup> On the other hand, in this period the group was under intervention by a protocol based on Hospitalized Elder Life

Program(HELP) for each of these risk factors. (Table-I) These interventions included:

1. Reorientation, once a day for every patient and three times a day with cognitive stimulants who had this risk factor.
2. Non-pharmacological intervention to repair sleep (massage, warm drink before sleep, reduce noises or light modification for all patients.
3. Mobility program appropriate to physical situation three times a day for all.
4. Use of accessory instruments (glasses, speaker, ear aid, big words...) for patients with auditory or visual impairment.
5. Necessary help with eating and drinking in patients with dehydration.<sup>9</sup>

Before doing these exercises, 16 patients with same age had been enrolled in the study which had made the control group. In this group also at first, delirium had been ruled out by the same tests and then the same risk factors with the same tests had been used two days after operation of the first case group. All of them were supposed to have sleep disturbance as a risk factor. They had been interviewed to detect delirium twice a day (morning and evening) for five days after operation. At the end of fifth day, patients in both groups for each risk factor were assessed again and

alterations were recorded (decreased or increased or the same). Significant decrease based on (HELP) consisted of:

1. Two score changing in Katz A.D.L
2. Two score changing in M.M.S.E
3. Score more than 20/70 during 48 hours in Standard Jaeger test
4. One score changing in whisper test
5. Five score changing in BUN to creatinine ratio in serum
6. Decrease of using sleep drugs.<sup>9</sup>

Finally, the amount of alterations in each of risk factors were calculated in both groups and the amount of alteration for total risk factors in both groups were calculated. Finally incidence of delirium was compared between case and control groups.

For analysis of information t-test, Man Whitney and comparing ratios test(S-Plus) were used.

## RESULTS

Demographic characteristics in both groups were similar and there were little differences between them in this aspect. Prevalence of each of risk factors and median of number of risk factors in each group was almost similar to other group, two days after operation. (Table-II)

Regardless to the changes in each of the risk factors and in the median number of risk factors in both groups at the end of fifth day, there was a significant reduction in median number of risk factors in case group compared to control group. ( $df=30, t=2.875, P<0.007$ ) and there was a significant reduction in prevalence of immobility as a risk factor in case group compared to control group at the end of fifth days, too. ( $df=30, t= 2.677, P<0.012$ ) As regards other risk factors, their prevalence in case group compared to control group reduced at the end of fifth day but reductions were not significant. (Table-III)

Incidence of delirium in control group was 4(25%) and 0 in case group, whereas reduction in case group compared to control group was not significant. ( $P<0.144$ ).

Table-I: Hospitalized Life Program

<ol style="list-style-type: none"> <li>1) Cognitive impairment: Note surgeon's name, time and date to patient three times a day and ask him/her about them</li> <li>2) Sleep disturbance: Non pharmacological interventions (if there is no contraindication): warm drink(tea or milk), mild massage, reducing environmental noises</li> <li>3) Helping patient to move his/her limbs actively or passively (three times a day). Reducing use of instruments like bladder catheter or physical restriction if it is possible</li> <li>4) Visual impairment: Give to the patient his/her glasses and encourage him/her to use it*</li> <li>5) Auditory impairment: Clean ears and if the patient uses ear aid, give it to him/her*</li> <li>6) Dehydration: Remove it by oral or parental hydration and encourage patient to drink (if there is no contraindication)*</li> </ol>
* If the impairment exist

Table-II: Characteristics of patients at second day after operation

Characteristics	Case group	Control group
Average of age	58.68 SD*±5.52	62.58 SD±7.25
Male/Female	9/7	10/6
CABG**/other	15/1	15/1
Educated / Uneducated	8/8	9/7
Average of M.M.S.E*** scoreTarget risk factors****	26.31	26.12
Cognitive impairment (%)	3(18.8)	4(25)
Immobility (%)	16(100)	16(100)
Visual impairment (%)	4(25)	6(37.5)
Dehydration (%)	6(37.5)	7(43.8)
Auditory impairment (%)	4(25)	4(25)
Median no. of risk factors	3	3

\* Standard deviation

\*\* Coronary Artery Bypass Graft

\*\*\*Mini Mental Status Examination

\*\*\*\*All of patients were supposed to have sleep disturbance

## DISCUSSION

Some previous studies have reported that the use of educative protocols could reduce signs and symptoms of delirium significantly. Inouye focused on six main risk factors of delirium (visual, auditory and cognitive impairments, immobility, dehydration and sleep disturbance) and Hospitalized Elder Life Program has been used for elderly patients over 65 years of age. Finally there were significant reductions in incidence of delirium, cognitive impairment, sleep disturbance and total number of risk factors. In our study, there were significant reductions in median number risk factors and immobility and non significant reductions in other risk factors and incidence of delirium. Some probable causes for the differences between these two studies may be the lower prevalence of alcohol use in Iran and development in the operation techniques.

Limitations of the study include small size of samples, average of less than 65 years of age focusing on just one cause of delirium (post operative), not measuring severity of delirium

Table-III: Changes in risk factors at the end of fifth post operative day

Risk factors	Case group	Control group	P C.I*= 95%
<i>Cognitive impairment</i>			
N at 2nd POD	3	4	---
Improved (%)	2(66.66)	0	
Unimproved (%)	1(33.33)	4(100)	0.123
<i>Visual impairment</i>			
N at 2nd POD	4	6	---
Improved (%)	3(75)	1(16.66)	---
Unimproved (%)	1(25)	5(83.33)	---
<i>Auditory impairment</i>			
N at 2nd POD	4	4	---
Improved (%)	2(50)	1(25)	---
Unimproved (%)	2(50)	3(75)	0.782
<i>Immobility</i>			
N at 2nd POD	16	16	---
Improved (%)	7(43.7)	1(6.2)	---
Unimproved (%)	9(56.3)	15(93.8)	0.012
<i>Dehydration</i>			
N at 2nd POD	6	7	---
Improved (%)	4(66.66)	2(28.57)	---
Unimproved (%)	2(33.33)	5(71.43)	0.252
<i>Sleep disturbance</i>			
N at 2nd POD	16	16	---
Improved (%)	10(62.5)	7(43.7)	---
Unimproved (%)	6(37.5)	9(56.3)	0.478
<i>Median of number of risk factors</i>			
At 2nd POD	3	3	---
At 5th POD	1	2	0.007

N= No. of Patients

POD = Postoperative Day

C.I = Confidence Interval

and low frequency of interview during 24hour. So authors suggest that future studies should be conducted with larger size of samples specially focusing on the causes and elderly patients.

Overall, it seems the use of prophylactic protocols to prevent delirium in medical and surgical setting is extremely useful which can prevent morbidity and mortality in such patients.

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