Intensive Care Unit delirium: A wide gap between actual prevalence and psychiatric referral

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Abstract

Background and Aims: The study aimed to assess the rates of delirium in an Intensive Care Unit (ICU) prospectively assessed with a delirium screening instrument and confirmed through psychiatrist evaluation. In addition, the referral rate to psychiatric consultation liaison services from the same ICU was assessed through the rates of psychiatric referral over the previous 10 years.

Material and Methods: In the prospective part of the study, consecutive patients aged 16 years or more admitted to the ICU of a tertiary care hospital were assessed daily for delirium using confusion assessment method for the ICU, a validated instrument that can be used for both mechanically ventilated and nonventilated patient by trained health care personnel. Retrospectively, records of patients referred to psychiatric referral team for delirium from the ICU over the last 10 years were drawn out and the referral rate was calculated.

Results: In the prospective study, 109 patients were recruited of which 43 patients remained comatose throughout their ICU stay and could not be assessed for delirium. Of the 66 assessable patients, 45 (68.2% prevalence rate) patients developed delirium. Incidence rate of delirium was 59.6%. In contrast, the retrospective study showed that only 53 cases out of 3094 admissions in ICU over 10 years (1.71%) were referred to psychiatry consultation liaison team for management of delirium. In the prospective study, hypoactive delirium was the most common subtype of delirium.

Conclusion: There is a mismatch between the incidence and prevalence of delirium in ICU patients prospectively diagnosed with structured, validated instruments and the diagnosis of delirium in cases referred to psychiatry consultation-liaison services.

Key words: Delirium, incidence, outcome, prevalence, subtype

Introduction

Delirium is a form of brain dysfunction, which is associated with dysregulation of cholinergic, dopaminergic and GABAergic, serotonergic, and norepinephrine neurotransmitters. It is said to be related to the brain’s response to the injury and resultant inflammatory response. Delirium is frequent in the medical and surgical Intensive Care Units (ICUs) with prevalence rates ranging from 32.3% to 77% and the incidence rates varying from 45% to 87%. Delirium in ICU requires as much attention as other organ failures because it is independently associated with prolonged ICU stay, increased cost of treatment, higher mortality, and long-term cognitive decline. Existing literature suggests that delirium as a clinical entity is often missed by the treating physicians and nurses. The diagnosis of delirium is often missed as it may be confused with other psychiatric disorders such as depression and manifestation of medical disorders.

How to cite this article: Grover S, Sarkar S, Yaddanapudi LN, Ghosh A, Desouza A, Basu D. Intensive Care Unit delirium: A wide gap between actual prevalence and psychiatric referral. J Anaesthesiol Clin Pharmacol 2017;33:480-6.
the mortality rates and financial healthcare burden. At times, details of delirium are often not incorporated in the discharge summaries.\cite{23} Factors that increase the likelihood of a missed diagnosis of delirium includes the presence of past psychiatric diagnosis,\cite{19,20} pain as a major symptom,\cite{19} hypoactive subtype of delirium,\cite{26} and younger age.\cite{20,25} It has also been suggested that delirium is more often missed in the ICUs than the general medical wards.\cite{26}

Though systematic studies have been conducted to assess the incidence and prevalence of delirium in ICU settings\cite{27,28} and to understand the referral rates of delirium in the consultation-liaison psychiatry practices,\cite{29,30} there is a paucity of data that assesses the actual referrals rates and actual prevalence rate of delirium in various ICUs.

Although some of the previous studies from India have tried to study the incidence and prevalence of delirium in various ICU set ups,\cite{31,32} none of the studies have evaluated the gap in the identification rates. In this background, this study aimed to assess the:

1. Rates of delirium in an ICU prospectively assessed with a delirium screening instrument and confirmed through psychiatrist evaluation;
2. Additionally, this study evaluated the referral rate to psychiatric consultation liaison services from the same ICU based on the rates of psychiatric referral over the previous 10 years.

**Material and Methods**

**Setting of the study**

The study was carried out in the ICU of a multidisciplinary tertiary care hospital which is managed by the Department of Anaesthesia and Intensive Care. It is a 12 bedded facilty which caters to the patients from Medical and Surgical Departments. Whenever a patient is admitted to the ICU care is provided by the anesthesiologists in conjunction with the primary treatment team. Once stabilized, the patient is shifted out of the ICU and care is provided by the primary treating team.

Besides the primary treating team, the ICU team often consults physicians/surgeons from other specialties depending on the need of the patient. The psychiatry consultation liaison team is often consulted for patients having delirium, other psychiatric morbidities, alcohol and drug dependence, breaking bad news, etc.

Depending on the need, patients are usually given midazolam for sedation, in the minimum required doses, and the same is withdrawn slowly, efforts are made to wean off the patients from the ventilators as early as possible, and patients are mobilized at the earliest possible.

**Ethical clearance and consent**

The study was approved by the ethics review board of the hospital and written informed consent was obtained from the family members of the patients prior to recruitment.

**Sampling**

For the prospective arm of the study, consecutive patients aged 16 years or more admitted to the ICU during the period of February 2013 to June 2013 formed the study cohort. Those patients were excluded where the family member refused to provide written informed consent. The patients were assessed between 5 and 8 pm daily on the Richmond Agitation and Sedation Scale\cite{33,34} to assess the level of sedation and agitation. Those patients found to be arousable (–3 to +4) were screened by using the confusion assessment method for ICU (CAM-ICU)\cite{35} for the presence of delirium by a qualified psychiatrist. Those patients who screened positive for delirium on CAM-ICU were further assessed by the same qualified psychiatrist for the diagnosis of delirium as per the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision diagnostic criteria.\cite{36} Amended delirium motor checklist was used to assess the type of delirium (hyperactive, hypoactive, or mixed). Acute Physiology and Chronic Health Evaluation-II (APACHE-II) was used to assess the severity of medical comorbidity. An etiological checklist was specifically designed for this study. All the variables included in the etiological check list were rated as “present” or “absent” based on the history, investigation reports, and continuous monitoring of patients. APACHE-II\cite{37} to score, Sequential Organ Failure Assessment (SOFA) score,\cite{38} and Charlson comorbidity index\cite{39} were calculated to measure the severity of disease, the extent of organ dysfunction and as a predictor of 10 years mortality, respectively. Amended delirium motor symptom scale\cite{40} was used to subtype delirium.

The patients were followed until the point of discharge from ICU or death. The ICU team was informed about those found to have delirium for appropriate management, and all the assistance was provided by the psychiatrists involved in the study in the management of cases.

**Retrospective arm of the study**

For the retrospective arm of the study, the registry of the psychiatry consultation liaison services was reviewed for the duration of 10 years (April 2002-March 2012) to identify the cases referred to the psychiatry consultation liaison services from the same ICU. Of these patients diagnosed as having delirium by the psychiatry consultation liaison...
services were identified. In routine clinical practice, delirium was diagnosed as per the International Classification of Diseases-10 criteria.

Data were obtained from the hospital statistics to obtain the total number of admissions to the ICU during April 2002-March 2012.

The prospective arm of the study included 109 patients, and the retrospective arm of the study included 108 referrals from ICU to the psychiatry consultation liaison team.

**Statistical analysis**
Statistical analysis was carried out using SPSS version 14 for Windows (Chicago, Illinois, USA). Descriptive statistics such as mean, standard deviation (SD), median, frequency, percentage, and range were used to represent the characteristics of the sample. Inferential statistics in the form of Chi-square test and Fisher’s exact test for dichotomous variables and Student’s t-test and Mann-Whitney U-test for continuous variables were applied for comparisons. One-way ANOVA was used to make comparisons when a number of subgroups was more than two and comparisons were made with continuous variables. Binary logistic regression analysis was used to evaluate the predictors of delirium.

**Results**

**Incidence and prevalence of delirium in the prospective study**
Over the study period, 124 patients were admitted to the ICU. Of them, nine cases were excluded because they were aged <16 years and six cases were shifted out of ICU or died prior to being approached for the study. None of the patients’ family members refused consent for the study. The final study sample comprised of 109 patients. Of these, 43 patients remained comatose throughout their ICU stay and could not be assessed for delirium. Of the remaining 66 patients, 45 (68%) patients developed delirium. Of the 66 patients assessed for delirium, 14 (21.2%) patients were found to have delirium at the first assessment (i.e., within 24 h of admission to ICU). Of the remaining 52 patients not found to have delirium at the first assessment, 31 (59.6%) developed delirium after 24 h of ICU stay and were considered to be incidence cases [Figure 1].

**Delirium in psychiatry referrals from Intensive Care Unit-retrospective study**
Over a period of 10 years, 3094 patients were admitted to the ICU. Of these 108 patients were referred to psychiatry for which a diagnosis of delirium was made by Psychiatry Consultation Liaison team and out of these 53 (49%) were diagnosed to have delirium. Accordingly, only 1.7% (53 out of 3094) of patients was diagnosed with delirium by the psychiatry referral team. These patients were mostly (90% of cases) referred to psychiatry liaison team for abnormal behavior in the form of pulling out tubings. None of the patients was started on antipsychotics prior to evaluation by the psychiatrist for the management of delirium.

**Demographic and clinical characteristics of patients in the prospective arm of the study**
The mean age of the study sample was 41 (SD - 17.5) years and there was no significant difference between the age of patients who could be assessed and those who remained comatose during the study period. Similarly, there was no difference in the age among those who developed delirium and who did not develop delirium during the study period. Only nine patients were aged more than 65 years and there was no difference in the prevalence of delirium across those aged <65 years and those aged 65 or more. The majority of the patients were male and educated beyond 10 years. Two-third of the patients was admitted to the ICU mainly because of medical illnesses.

The mean APACHE-II score of the study sample was 14.8 (SD - 7.3), the mean SOFA score was 4.3 (SD - 3.3) and the mean Charlson comorbidity index was 0.89 (SD - 1.36). The median of APACHE-II of the patients who developed delirium was 14 with inter quartile range of 10-20. For the group which did not develop delirium, the median was 9 (inter quartile range 6-12) and the group which remained...
comatose the median of APACHE-II was 16 (inter quartile range 11-20). The median of SOFA score for those with delirium was 3 (inter quartile range 2-5.5), those who did not develop delirium was 2 (inter quartile range 1-4), and those who remained comatose was 4 (inter quartile range 3-8).

Those who developed delirium had significantly higher mean APACHE-II score and mean Charlson comorbidity index score than those who did not develop delirium. On the other hand, the mean APACHE-II and SOFA score of patients who could not be assessed for delirium was higher than the assessable patients. However, among the patients assessable, mean APACHE-II, and SOFA scores did not differ as the significant predictors of delirium in the binary logistic regression analysis.

With regards to the etiological factors, besides the acid base imbalance and respiratory compromise (which were present in all cases at the time of admission to ICU) and one or more organ failure, most common etiological factor was presence of infection. Other abnormalities seen in about 30% patients included renal decompensation, hypo/hypernatremia, hypo/hyperkalemia, and anemia. The majority of the patients were receiving more than 3 medications; significantly higher percentage of those who were not assessable was receiving more than 3 medications. The mean number of etiological factors associated with development of delirium in the present study was 4.3 (SD - 2.0). There was no difference in terms of prescription of antihistamines, steroids, and nonsteroidal anti-inflammatory drugs among patients who developed delirium and those who did not develop delirium. Those with and without delirium and those assessable and not assessable also did not differ significantly with regards to number of etiologies which could have contributed to development of delirium.

Motor subtype of patients in the prospective arm of the study
The hypoactive subtype (n = 21, 47% of the cases) was the most common motoric subtype of delirium. This was followed by the mixed subtype (n = 13, 29%) and hyperactive subtype (n = 11, 24.5%) was the list common subtype of delirium.

Outcome of patients with delirium in the prospective arm of the study
In terms of outcome, 28.4% of patients died during the ICU stay, with significantly higher mortality in nonassessable patients. Although compared to those who did not develop delirium, a higher proportion of patients who developed delirium expired during the ICU stay, the difference between the two groups were not statistically significant. The different motoric subtypes did not significantly differ in terms of duration of hospital stay. Although compared to other subtypes, a higher proportion of patients with hypoactive delirium expired (mortality of 30.0% in the hypoactive subtype, 8.3% in the mixed subtype and none in the hyperactive subtype), the difference was statistically nonsignificant ($\chi^2 = 5.457, P = 0.065$) [Table 1].

Discussion
The present study shows that the prevalence rate of delirium to be 68.2% and the incidence rate of delirium to be 59.6% in patients admitted to the ICU. However, the referral rate for delirium was abysmally low, i.e., 1.7% when one relies on the referral rates. This finding indicates that there is a huge mismatch between the incidence and prevalence of delirium in ICU patients prospectively diagnosed with structured, validated instruments. However, this finding must be interpreted in the light of the fact that we specifically did not evaluate the knowledge of the staff involved in the management of patients in ICU, about delirium.

Such a wide difference can be ascribed to many factors. One of the reasons can be a lower degree of sensitization of ICU physicians and the nursing staff toward the diagnosis of delirium, or a lack specific training to detect delirium. Worldwide literature suggests that a large proportion of cases of delirium in the medically ill may be missed.[19,24] It has been suggested that hypoactive delirium may be more often missed[24] as these patients are less markedly noticeable when compared to hyperactive delirium. Concurring with such lines of evidence, our retrospective data also suggests that consultation was sought mostly for “abnormal behavior” since this interferes with the management of the patient (suggesting that the hyperactive subtype of delirium was referred most frequently, and perhaps the other and far more common hypoactive subtype was ignored). Another possible explanation that could attempt to answer the discrepancy in the rates of delirium may be that it is also quite possible that the anesthetists treated the delirium themselves and rarely sought psychiatric consultation. However, this seems unlikely because the finding of the retrospective arm of the study showed that none of the patients was receiving antipsychotics prior to evaluation by the psychiatrist. Although it can be argued that the anesthetist attempted to manage delirium by correcting the underlying causes of delirium and possibly using nonpharmacological management strategies such as ensuring adequate sleep without any noise, adequate pain management, avoiding constipation or urinary retention, and avoiding restraints. Due to these antipsychotic medications were not used. However, if one just takes the prevalence rate of hyperactive delirium in the prospective arm of this study, it
Table 1: Demographic and clinical characteristics of patients

| Variables                        | n (%) or mean (±SD) | Student’s t-test/χ² value (significance) |
|---------------------------------|---------------------|----------------------------------------|
|                                 | Total patients      | Developed delirium | Remained delirium free | Remained comatose throughout | Assessable versus not assessable | Delirium versus no delirium |
|                                 | enrolled (n = 109)  | (n = 45)           | (n = 21)               | (n = 43)                     |                                 |                             |
| Age                             | 40.9 (±17.5)        | 40.7 (±18.3)       | 39.7 (±14.3)           | 41.8 (±18.3)                | 0.12 (0.902)                    | 0.47 (0.640)                 |
| Male gender                     | 68 (62.4)           | 32 (71.2)          | 10 (47.7)              | 26 (60.5)                   | 0.11 (0.738)                    | 3.41 (0.065)                 |
| Educated above 10th             | 60 (55.1)           | 25 (55.6)          | 13 (62)                | 22 (51.2)                   | 0.43 (0.511)                    | 0.23 (0.627)                 |
| Patients belonging to medical specialty | 73 (67)             | 32 (71.2)          | 16 (76.2)              | 25 (58.2)                   | 2.50 (0.113)                    | 0.18 (0.666)                 |
| APACHE-II score                 | 14.8 (±7.3)         | 16.5 (±6.5)        | 10.1 (±5.9)            | 15.3 (±7.9)                 | 2.03 (0.045)*                   | 2.97 (0.004)**               |
| SOFA score                      | 4.3 (±3.3)          | 5.3 (±3.4)         | 2.7 (±1.9)             | 4.2 (±3.5)                  | 2.43 (0.016)*                   | 1.89 (0.063)                 |
| Charlton comorbidity index      | 0.89 (±1.36)        | 0.98 (±1.42)       | 0.48 (±0.60)           | 1.00 (±1.53)                | 0.648 (0.519)                   | 2.142 (0.048)*               |
| Etiologies                      |                     |                     |                       |                             |                                 |                             |
| Increased urea/creatinine       | 40 (36.7)           | 13 (28.9)          | 3 (14.3)               | 14 (32.6)                   | 0.11 (0.738)                    | 1.63 (0.197)                 |
| Hypo/hypernatremia              | 34 (31.2)           | 15 (33.4)          | 5 (23.9)               | 14 (32.6)                   | 0.90 (0.342)                    | 0.61 (0.433)                 |
| Hypo/hyperkalemia               | 34 (31.2)           | 14 (31.2)          | 7 (33.4)               | 13 (30.3)                   | 0.03 (0.841)                    | 0.03 (0.857)                 |
| Abnormal albumin levels         | 11 (10.1)           | 7 (15.6)           | 2 (9.5)                | 2 (4.7)                     | 2.317 (0.128)                   | 0.44 (0.506)                 |
| Anemia                          | 32 (29.4)           | 14 (31.2)          | 5 (23.9)               | 13 (30.3)                   | 0.02 (0.871)                    | 0.37 (0.582)                 |
| Diabetes mellitus               | 24 (22.1)           | 4 (8.9)            | 6 (28.6)               | 14 (32.6)                   | 0.02 (0.874)                    | 4.31 (0.038)                 |
| Hypertension                    | 12 (11.1)           | 3 (6.7)            | 2 (9.6)                | 7 (16.3)                    | 2.01 (0.156)                    | 0.16 (0.683)                 |
| Road traffic accident           | 20 (18.4)           | 9 (20)             | 1 (4.8)                | 10 (23.3)                   | 1.14 (0.285)                    | 2.58 (0.108)                 |
| Number of medications >3        | 88 (80.8)           | 34 (75.6)          | 17 (81)                | 37 (86.1)                   | 1.28 (0.256)                    | 0.23 (0.626)                 |
| On antihistaminics              | 24 (22.1)           | 7 (15.6)           | 3 (14.3)               | 14 (32.6)                   | 4.59 (0.032)*                   | 0.01 (0.893)                 |
| On steroids                     | 25 (23)             | 8 (17.8)           | 5 (23.9)               | 12 (28)                     | 0.99 (0.319)                    | 0.32 (0.566)                 |
| On NSAIDS                       | 11 (10.1)           | 3 (6.7)            | 1 (4.8)                | 7 (16.3)                    | 2.99 (0.083)                    | 0.09 (0.763)                 |
| Infective etiology              | 66 (60.6)           | 29 (64.5)          | 9 (42.9)               | 28 (65.2)                   | 0.62 (0.431)                    | 2.73 (0.098)                 |
| Other etiologies†               | 0.6 (±1.0)          | 0.7 (±1.1)         | 0.3 (±0.6)             | 0.6 (±0.9)                  | 0.09 (0.926)                    | 1.69 (0.095)                 |
| Mean number of etiologies       | 4.3 (±2.0)          | 4.2 (±2.1)         | 3.5 (±1.1)             | 4.7 (±2.1)                  | 1.82 (0.071)                    | 1.93 (0.057)                 |
| Impact of delirium              |                     |                     |                       |                             |                                 |                             |
| Duration of ICU stay            | 14.1 (±15.1)        | 10.2 (±11.6)       | 12.8 (±9.3)            | 18.0 (±18.8)                | 2.01 (0.047)*                   | 1.20 (0.233)                 |
| Outcome as died*                | 31 (28.4)           | 7 (16.3)           | 1 (4.8)                | 23 (62.2)                   | 27.18 (<0.001)**               | 1.71 (0.191)                 |

†Etiologies were evaluated continuously. For the analysis, all the etiological abnormalities found prior to development of delirium were considered as contributory factor in those who were found to have delirium. Similarly, the etiological list was updated regularly for those who did not develop delirium or were not assessable. The category of other etiologies included: Receiving furosemide (n = 8), receiving antiepileptics (n = 6), hypocalcemia (n = 6), alcohol use disorder (n = 5), receiving opioids (n = 5), seizures (n = 4), congestive cardiac failure (n = 3), marked physical disability at the time of admission (n = 3), benzodiazepine use ≥2 weeks prior to admission (n = 2), receiving warfarin (n = 2), history of MI (n = 1), stroke (n = 1). APACHE-II = Acute Physiology and Chronic Health Evaluation II, SOFA = Sequential organ failure assessment, NSAIDS = Nonsteroidal anti-inflammatory drugs, ICU = Intensive care unit, SD = Standard deviation, MI = Myocardial infarction, *P < 0.05, **P < 0.01, ***P < 0.001

can be said that avoidance of antipsychotics, which are one of the important intervention for hyperactive delirium in agitated patients, it can be said that strategies followed by anesthetists still seems to be suboptimal for management of delirium.

The high incidence and prevalence of delirium suggest that as a clinical entity, delirium requires adequate attention, and appropriate management. Considering the incidence and prevalence rates, a psychiatrist must be involved as part of the ICU team (liaison model of consultation-liaison services)[41] who can identify cases at the earliest and enhance the skills of the physicians’ to identifying and managing delirium. However, if this is not possible, then there is a need to train the staff (anesthetists and nursing staff) involved in the management of patients in ICU to identify and manage delirium.

In this study, those who developed delirium had significantly higher APACHE-II score and Charlson comorbidity index score than those who did not develop delirium. These findings suggest that delirium is more frequently seen in those with more severe physical illness, and this finding is similar to previous studies.[31,42,43] This suggests that anesthetists should keep this fact in mind while dealing with patients admitted to ICU and the available expertise’s to identify and manage delirium should focus on patients with higher level of decompensation and higher severity of illnesses.

Presence of infection as the most common etiological factor contributing to development of delirium is similar to the findings of previous studies from India, which have reported infection/sepsis as the most common etiological factor associated with the development of delirium in ICU[31] and those seen in psychiatry consultation-liaison services.[41] The mean number
of etiological factors associated with development of delirium in the present study was 4.2, and this was slightly more than that reported for patients with delirium seen by psychiatry consultation liaison services from India.

The present study clearly shows that hypoactive delirium is the most common motoric subtype of delirium seen in the ICU setting, and this finding is similar to that reported from west and developing countries.\textsuperscript{31} Compared to previous studies, in the present study, the motoric subtyping was done by using a standardized motor checklist rather than based on the findings of a single item on various delirium rating scales, as done in some of the previous studies.\textsuperscript{31,44} This finding also has important clinical implications in the form of need to train the ICU physicians to identify hypoactive delirium.

Certain limitations of the study should be considered while interpreting the results. The present study reflects the characteristics and outcome from a general purpose ICU, which admits patients from various specialties. Furthermore, the present study represents findings from a single center. Hence, the results may not be generalizable to specialty ICU setting like trauma and respiratory ICU, etc., as the clinical profile of patients admitted to these ICUs may be different from those admitted to an ICU used for management of patients with heterogenous clinical entities. The assessment for delirium was done once daily and hence transient episodes of delirium could have been missed. The sample size of the prospective arm was guided by the study duration. Accordingly, the study was limited to a relatively smaller sample size and future studies involving larger sample size are warranted. In addition, limitations of retrospective data based studies do apply to the retrospective arm of this study too. We also did not evaluate the impact of delirium on other factors such as the cost of treatment, long-term cognitive functions, and long-term mortality. We also did not evaluate the knowledge and skills of the anesthetists and nursing staff in diagnosing delirium. Futures studies must attempt to overcome these limitations.

**Conclusion**

To conclude, the present study suggests that a large proportion of patients admitted to ICU develop delirium and possibly many of the cases do not receive desired clinical attention. Given the fact that delirium (especially hypoactive) is associated with poorer outcomes and appropriate management strategies can help in early resolution of delirium,\textsuperscript{45,46} it is obvious that efforts to systematically identify delirium using brief screening measures can be helpful in improving patient outcomes. There is a need to reliably identify delirium using simple and structured instruments, and improving the treatment of ICU patients. Considering the high prevalence rate of delirium, there is a need to prevent delirium. Accordingly, proper assessment to identify the patient at risk for development of delirium by the ICU team, screening patients at regular intervals, avoiding medications which can predispose a patient to develop delirium and using nonpharmacological strategies can help in reduction in the burden of delirium and improvement of clinical outcome of patients admitted to ICUs. Accordingly, the clinicians and/or nursing staff managing the patients in the ICUs should routinely screen the patients for delirium and nonpharmacological preventive measures such as frequent reorientation and providing adequate stimulation should be instituted at the earliest. Those patients who develop delirium should be managed with appropriate medications to reduce the ICU morbidity and mortality.

**Financial support and sponsorship**
Nil.

**Conflicts of interest**
There are no conflicts of interest.

**References**

1. Meyer NJ, Hall JB. Brain dysfunction in critically ill patients – The intensive care unit and beyond. Crit Care 2006;10:223.
2. Arend E, Christensen M. Delirium in the intensive care unit: A review. Nurs Crit Care 2009;14:145-54.
3. Bruno JJ, Warren ML. Intensive care unit delirium. Crit Care Nurs Clin North Am 2010;22:161-78.
4. Girard TD, Pandharipande PP, Ely EW. Delirium in the intensive care unit. Crit Care 2008;12 Suppl 3:S3.
5. Agarwal V, O'Neill PJ, Cotton BA, Pun BT, Haney S, Thompson J, et al. Prevalence and risk factors for development of delirium in burn intensive care unit patients. J Burn Care Res 2010;31:706-15.
6. Salluh JI, Soares M, Teles JM, Ceraso D, Raimondi N, Nava VS, et al. Delirium epidemiology in critical care (DECCA): An international study. Crit Care 2010;14:R210.
7. Ely EW, Inouye SK, Bernard GR, Gordon S, Francis J, May L, et al. Delirium in mechanically ventilated patients: Validity and reliability of the confusion assessment method for the intensive care unit (CAM-ICU). JAMA 2001;286:2703-10.
8. Roberts B, Rickard CM, Rajbhandari D, Turner G, Clarke J, Hill D, et al. Multicentre study of delirium in ICU patients using a simple screening tool. Aust Crit Care 2005;18:6.
9. Thomason JW, Shintani A, Peterson JF, Pun BT, Jackson JC, Ely EW. Intensive care unit delirium is an independent predictor of longer hospital stay: A prospective analysis of 261 non-ventilated patients. Crit Care 2005;9:R375-81.
10. Ely EW, Gautam S, Margolin R, Francis J, May L, Speroff T, et al. The impact of delirium in the intensive care unit on hospital length of stay. Intensive Care Med 2001;27:1892-900.
11. Lin SM, Liu CY, Wang CH, Lin HC, Huang CD, Huang PY, et al. The impact of delirium on the survival of mechanically ventilated patients. Crit Care Med 2004;32:2254-9.
12. Ouimet S, Kavanagh BP, Gottfried SB, Skrobik Y. Incidence, risk factors and consequences of ICU delirium. Intensive Care Med 2007;33:66-73.
