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Risk Factors for Delirium in the Acute Stroke

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1. Introduction

1.1 Stroke

According to the World Health Organization (WHO), stroke is defined as the sudden development of focal or global symptoms and signs of disturbance of cerebral function lasting more than 24 hours or leading to death, as a result of the pathological processes of vascular origin (Thorvaldsen et al., 1995).

The basic classification of stroke, according to the type of pathological process, is into ischemic stroke, which comprises 70-85%, and hemorrhagic. An ischemic stroke develops due to the inability of supply to brain tissue oxygen and glucose due to occlusion vessel. If the "outbursts" of blood within the brain mass, there is intracerebral hemorrhage, which makes 15-20% of strokes, while the penetration of the blood in the subarachnoid space, usually as a result of aneurysm rupture, leading to a subarachnoid hemorrhage, which makes 5-10% of all strokes.

Stroke leads to focal or multifocal neuropsychological disorders. Given that in clinical stroke in the forefront of motor deficits, disturbance of consciousness and disturbance of speech functions, a very common disorder and the function of other organ systems, most of the neuropsychological symptoms are observed after the acute phase when the general and neurological status stabilized, or when we are able to perform certain neuropsychological tests (Dostović, 2007).

Stroke leads to the different degree of physical, cognitive and psychosocial dysfunctioning. The recovery of patients depends on the severity of disability, the rehabilitation program, but also the subsequent maintenance of achieved function, as well as care and support of family and environment.

1.2 Delirium

According to the International Classification of Diseases and Related Health Problems-Tenth Revision of 1994 delirium, not caused by alcohol or other psychoactive substances, is etiologically nonspecific organic cerebral syndrome, characterized by the simultaneous disturbance of consciousness and attention, perception, thinking, psychomotor behavior,

sense of rhythm of sleep and wakefulness. Running time is different, and the degree ranges from mild to very severe (Anonymous, 1994).

Includes:
- Acute or subacute syndrome of the brain
- Acute or subacute confusing
- Acute or subacute infectious psychosis
- Acute or subacute organic reaction
- Acute or subacute organic psihosindrom

Excludes:
- delirium tremens, caused by alcohol withdrawal state with delirium.

The most important feature of delirium is a disturbance of consciousness accompanied by a change in cognition that can not be better explained by an existing cognitive dysfunction. The disorder develops in a short period of time, usually within hours or days, and tends to fluctuations during the course (Anonymous, 1994).

Delirium is also defined as a transient, essentially reversible dysfunction of brain metabolism, acute or subacute at the beginning of the clinical manifestations, with a wide range of neuropsychological disorders (Wise & Brandt, 1994).

2. Neuropathophysiology of post-stroke delirium

Delirium is one of the most common complications that older patients develop when they are admitted to hospital, affecting up to 30% of all older medical patients (Young & Inouye, 2007). Delirium is a severe, multi-factorial neuropsychiatric disorder with well-defined predisposing and precipitating factors. It is characterised by a disturbance of consciousness and a change in cognition that develop over a short period of time. The mental state characteristically fluctuates during the course of the day, and there is usually evidence from the history, examination or investigations that the delirium is a direct consequence of a medical condition, drug withdrawal or intoxication (Anonymous, 1994). Patients who develop delirium have a high mortality, longer in-patient stay, and higher complication rate, increased risk of institutionalisation and increased risk of dementia (Young & Inouye, 2007; Inouye et al., 1999). Delirium is frequently not recognised by physicians and poorly managed.

Up to one-third of cases of delirium may be preventable. Stroke is a known risk factor for the development of delirium (Ferro et al., 2002). The majority of studies of delirium have reviewed mixed medical, surgical, orthopaedic or ICU patients. There have been only a small number of studies that have assessed delirium post-stroke. These studies have yielded conflicting results and have screened for delirium using different measures at different time intervals.

Although delirium has numerous potential precipitating factors, the clinical presentation is generally similar, suggesting a common pathway in the pathogenesis of delirium. The main cause of delirium is probably disturbance in the neurotransmitter acetylcholine system, particularly in the reticular formation. Reticular formation in the brain stem is the control of attention, sleep and wakefulness.

Knowledge of the pathophysiology of delirium is quite fragmented (White et al., 2002). Delirium is associated with reduction of oxidative metabolism, primarily in the prefrontal areas.

Known anticholinergic drugs or other medications with anticholinergic effects or that bind to muscarinic receptors may also precipitate delirium (Trzepacz et al., 2000). The possibility

of delirium was higher in patients taking five or more medications with moderate anticholinergic activity (Lindsesay et al., 2002). Exposure anticholinergic medication was independently and specifically associated with an increase in delirium in elderly patients diagnosed with delirium (Han et al., 2001).

Anticholinesterase activity is increasing in the plasma of patients with delirium. Over the years the loss of cholinergic reserve and focal loss of acetylcholine in the nucleus basalis Meynerti may be the reason that delirium is common in the elderly and patients with dementia. Abnormal termination of the hypothalamic-pituitary-adrenal lines may play a role in the pathophysiology of delirium after acute stroke (Olsson, 1999).

Type II receptors for glucocorticoids, which are present during the high-level (stress) hormones, are heavily expressed in the hippocampus, and intact hipocampal formations, seem to be necessary for adequate negative feedback. Stroke and complications (pain and infection) are stress conditions, the leading to an increase glucocortikoid production, which is not adequately suppressed.

Gustafson et al. (1993) have registered higher corticoid levels and abnormal response to dexamethasone suppression test in patients with acute stroke. Immediately after the stroke, delirium is associated with increased sensitivity to corticoadrenal adrenocorticotropic hormonal stimulation and the decrease in glucocorticoid negative feedback. Corticoids are known to disrupt attention and memory.

Several neurotransmitter systems have been implicated, in particular acetylcholine and dopamine, but also serotonin, noradrenalin and gamma amino butyric acid (GABA). Functional acetylcholine (ACh) deficiency has received most support (Trzepacz , 2000). ACh is involved in several functions that are affected in delirium: arousal, attention, delusions, visual hallucinations, motor activity and memory (Lindsesay et al., 2002). The evidence for ACh involvement in delirium is strong. Anticholinergic drugs can cause delirium in susceptible patients (White, 2002; Lindsesay et al., 2002).

With respect to other neurotransmitter systems, dopamine may also be implicated (Trzepacz, 2000). Dopamine and ACh neurotransmitter systems interact closely and often reciprocally and an imbalance between the two could underlie delirium syndromes. There is evidence that dopamine excess can cause delirium and that dopamine antagonists, particularly neuroleptics, modify the symptoms of delirium (Itil & Fink, 1966). Glucocorticoids are also potentially implicated in delirium; and delirium has been reported in Cushing's syndrome.

Despite being a frequent complication of stroke, the pathophysiology of delirium in the acute stroke is poorly understood. There is no data on how an acute stroke affects neurotransmitter levels in the brain. Drugs with ACh activity are, however, associated with an increased risk of delirium in the acute stroke setting (Caeiro et al., 2004).

Recently, hypoperfusion in the frontal, parietal, and pontine regions have been demonstrated using single photon emission computed tomography (SPECT) scanning in patients with delirium (Fong et al., 2006). It is possible that hypoperfusion, in addition to the acute brain injury, may play an important role in the onset of delirium post-stroke. In addition, one study has found an association between delirium and hypercortisolism in the acute stroke setting (Gustafson, 1993). The pathogenesis of delirium in general remains unknown (White S, 2002).

There are several possible mechanisms for the development of delirium (Table 1).

Mechanism	Example
Altered neurotransmitters	Acetylcholine
	Dopamine
	Serotonin
	Noradrenaline, GABA, glutamate
Altered hypothalamic-pituitary-adrenal axis	Hypercortisolism
Other mechanisms	Cytokine production, e.g. interleukin-1
	Alterations to the blood–brain barrier
	Oxidative stress

Table 1. Possible mechanisms in the development of delirium, (McManus et al., 2007)

It is known that delirium is associated with generalised slowing on electroencephalogram (EEG) that is consistent with widespread cortical dysfunction, which presumably accounts for the wide range of symptoms that delirious patients present with.

3. Risk factors for development of post-stroke delirium

Delirium is a common behavioural disorder in patients with acute stroke (AS). We prospectively analyzed 59 patients with acute stroke in a six-month period in order to determine risk factors for delirium in these patients (Dostović et al., 2009 a,b). For all patients stroke was confirmed by computed tomography within 24 hours after hospitalization. The presence of delirium was assessed according the Delirium Rating Scale R-98 (Trzepac, 1999) and the Diagnostic and Statistical Manual of Mental Disorders - Fourth Edition criteria for delirium (Anonymous, 1994). According to the type of stroke, patients were divided into two groups: with ischemic and hemorrhagic stroke. Laboratory tests were done within the first four days of the stroke onset.
Delirious patients were significantly older (Table 2).

Age and sex	Delirium		Without delirium		Total		p-value
	n	%	n	%	n	%	
Male	25	23.1	83	76.9	108	100.0	
							0.5
Female	34	27.2	91	72.8	125	100.0	
Average age in years	70.0	$\pm$11.3	64.7	$\pm$10.4	66.0	$\pm$10.9	**0.001**

Table 2. Delirium frequency according to the age and sex

Delirium was more frequent in patients with hemorrhagic stroke (Table 3).

Type of stroke	Delirium		Without delirium		Total		p-value
	n	%	n	%	n	%	
Ischemic	44	22.3	153	77.7	197	100.0	
							0.02
Hemorrhagic	15	41.6	21	58.4	36	100.0	
Total	59	25.3	174	74.7	233	100.0	

Table 3. Delirium frequency according to the type of stroke

In patients with hypertension, delirium was significantly less prevalent (19.3%: 38.3%, p = 0.001), and diabetes had no statistically significant effect on the occurrence of delirium. Patients with delirium had significantly more pronounced leukocytosis, neutrophils, elevated aspartataminotransferasis, sedimentation rate and high temperature (>37.5 C) compared to those without delirium (Table 4).

Biochemical parameters	Delirium n = 59	Without delirium n = 174	p-value
Leucocytes	8.2 (2.9 – 25.5)	6.6 (3.3 – 20)	0.01
Neutrophils	5.7 (1.7 – 13.1)	4.3 (0.5 – 18.9)	0.0001
Triglycerides	1.3 (0.5 – 4.4)	1.6 (0.5 – 7.4)	0.03
AST	28 (7.8 –1008)	24 (11 – 126)	0.002
Potassium	4.0 (2.9 –5.3)	4.1 (3.2 –6.0)	0.04
Increased sedimentation	56 (94.9 %)	146 (83.9%)	0.05
High temperature	34 (57.6 %)	47 (27.0 %)	0.0001

AST – aspartataminotransferaza

Table 4. Biochemical parameters in acute stroke patients

Although stroke is a known predisposing factor for delirium, there have only been a few prospective studies of delirium in the acute stroke setting and these have given conflicting results with prevalence estimates ranging from 13 to 48%. In addition, different independent risk factors for post-stroke delirium have been identified including left-sided strokes, intracerebral haemorrhages, cardioembolic stroke, total anterior circulation infarction, age, neglect, pre-existing cognitive impairment and metabolic disorders post-stroke (Henon, 1999; Sheng, 2006; Dostović, 2007; Dostović et al., 2009 a).

In the one recent study delirium was found in 28% of acute stroke patients. No significant difference was found in the prevalence of delirium between male and female stroke patients. Patients who developed delirium were older than patients who did not. Two models were developed which identified independent determinants of developing delirium including: disphagia on admission, an Barthel score <10, a raised C-reactive protein on admission and poor vision pre-stroke. Pre-stroke cognitive impairment approached statistical significance as an independent predictor of delirium (McManus et al., 2009). These studies used different screening tools and different methodologies. The results of our study are similar to the results of mentioned studies. Precipitating factors for delirium are numerous and generally well recognised (Anonymous, 2006).

There is a predictive model that can identify those patients who will develop delirium after stroke. Apart from the usual predisposing factors, the beginning of delirium after stroke probably dependens on several factors unique to this clinical manifestation: the area of the brain affected by stroke, stroke size, type of stroke, the degree of cerebral hypoperfusion and cerebral edema, and medical complications after stroke.

Gustafson et al. (1991) found that a left-sided stroke is independent risk factors for delirium development. Caeiro et al. (2004) found that delirium was more frequent with hemispherical strokes and after intracerebral haemorrhages. Sheng et al. (2006) found that patients who had a cardioembolic stroke or total anterior circulation infarction (TACI) were more likely to develop delirium. In addition, case reports have suggested that delirium may be associated with specific lesions, for example, in the thalamus and caudate nucleus (Trzepacz, 2000).

Old age
Male gender
Dementia
Severe illness
Visual impairment
Psychiatric illness, in particular depression
Alcohol excess
Physical frailty
Polypharmacy
Malnutrition
Renal impairment
Dehydration

Table 5. Main predisposing factors for development of delirium, (McManus et al., 2007)

Certain types of stroke are more associated with the onset of delirium and complications after a stroke can accelerate the development of delirium. In essence, it is highly likely that the greater stroke cause delirium, but in such patients is increasing and likely to develop medical complications, which in itself can cause delirium. Primary trigger for the start of delirium may be different from case to case.

In patients with stroke, predisposing and precipitating factors for delirium, according to results of other studies are:0 age, extensive motor impairment, paralysis of the left half of the body, pre-existing cognitive decline, metabolic and infectious complications, the right hemisphere cortical lesions, the low score of daily activities, sleep apnea, body mass index less than 27, impaired vision (Gustafson et al., 1991; Henon et al., 1999; Sandberg et al., 2001).

High body temperature, elevated sedimentation rate, hypokalemia, elevated aspartatamniotransferaza, lower triglycerides, neutrophilia, leukocytosis, severe mobility problems, existing chronic diseases, metabolic and infectious complications, older age, a right-hemispheric lesions are possible precipitating factors for the delirium in the acute phase of stroke (Dostović, 2007; Dostović et al., 2009 a,b).

4. Diagnosis, incidence, management and outcome of post-stroke delirium

Delirium is diagnosed and classified according to the cause into: delirium caused by psychoactive substances (during exposure to a substance or during withdrawal), delirium due to general medical condition and vague delirium. The main feature of delirium is a disturbance of consciousness and cognitive functions that occur within a few hours or days, showing a distinct tendency of fluctuation during the day.

At night, the awareness is distinctly worse. A patient with impaired consciousness responds slowly, and its concentration is very difficult. Disturbance of consciousness in terms of disorientation in time and space, and to your self is extremely rare. Memory impairment is usually only for newer content. Speech is often slow and ambiguous and incoherent form of thought.

Behavior may be violent, aggressive and irritable, or passive, slow, docile. Sleep is often disturbed with altered sleep-wake cycle. Delusions may be present, which manifests itself in the form of persecution which are usually transient and not systematized. Disorders of perceptionis most often manifested in the form of illusions, misinterpretations or visual

hallucinations. The patient is very terrified. After his recovery he did not remember most events during the episode of delirium.

Delirium is frequently divided into hyperactive, hypoactive, and mixed types. Hyperactive delirium is characterised by increased motor activity with agitated behaviour. Hypoactive delirium is characterised by reduced motor behaviour and lethargy. Although hyperactive delirium has the best prognosis, hypoactive delirium is the most common form of delirium in elderly patients (Anonymous, 2006).

Camus and colleagues (2000) suggested that there are six symptoms suggestive of hypoactive subtype of delirium: lack of facial expression, motor slowing, slowing of speech, and the decrease in reactivity, confusion and mental slowing. Logorea, motor hyperactivity, aggressiveness, stereotype, hyper responsiveness and delusions are symptoms that indicate the hyperactive subtype of delirium.

As stroke is both a recognised predisposing and precipitating factor for delirium, all stroke patients should ideally be screened for delirium on admission and then at regular intervals. The ideal screening tool for the detection of delirium post-stroke would be quick, reliable, evidence-based, accurate, and easy to use by various health professionals, applicable to all stroke patients, able to distinguish between stroke patients with delirium and stroke patients with dementia, depression or psychosis and give an estimate of delirium severity. It should also rely less on level of consciousness, verbal ability and motor disturbance, since these may be independently affected by the cerebral damage secondary to the stroke. Unfortunately, no such tool exists.

Several screening tests for delirium have been developed for use in general hospital settings. No instrument has been specifically designed for the acute stroke setting and there is no consensus on which of the available measures is the best in the acute stroke setting.

The Mini Mental State Examination (MMSE) is a commonly used test to screen for cognitive impairment in routine clinical care. However, the MMSE was not designed to distinguish between delirium and dementia, and patients who were positive for cognitive impairment with the MMSE require further evaluation. The MMSE score is influenced by factors such as language, mood and sensory/motor function which render it unsuitable in the acute stroke setting.

The two most commonly used screening tools for delirium are the Confusion Assessment Method (CAM) (Inouye et al., 1990) and the Delirium Rating Scale (DRS) (Trzepacz, 1988). The CAM was developed in 1990, to be a simple test that general health professionals could use to identify delirium rapidly and accurately. The algorithm was devised from the DSM-III-R criteria for the diagnosis of delirium. Using this algorithm, the diagnosis of delirium is based on four features: acute onset and fluctuating course, and inattention with either disorganised thinking or altered level of consciousness. The CAM has high sensitivity and specificity (0.9) (Inouye et al., 1990). A recent study has highlighted, however, the need for appropriate training if the test is to be performed by nursing staff. The CAM has potential limitations in the acute stroke setting.

Stroke is accompanied with frequent changes in mental state as a result of acute brain lesions, which may contribute to erroneous assessment of the existence of delirium. Also, fluctuations in mental state after a stroke, for example, due to the brain edema can lead us into error in assessing the existence of delirium. Disruption of attention can be difficult to determine in patients with neglect or speech disorders, and assessment of memory disorder after stroke. Disturbance of consciousness is common after stroke and is a consequence of acute brain injury. Thus, while CAM is used frequently in general clinical practice, there is a need for its further validation for the assessment of delirium after acute stroke.

The DRS is a 10-item rating scale, intended for use by medical staff with specific training (Trzepacz et al. 1988). Individual item scores are totalled to generate a 32-point scale. A cut-off of 10 is usually used to diagnose delirium. The DRS allows for estimation of delirium severity. Among the five studies to date on delirium post-stroke, two have used the DRS. One used the DRS alone (Caeiro et al, 2004), the other used the DRS in addition to clinical (DSM-IV) criteria . The DRS and the CAM have been found to have good overall agreement in general medical in-patients (Adamis et al., 2005) but have never been compared in the acute stroke setting. Like the CAM, the DRS has limitations for assessing delirium post-stroke. Pre-stroke cognitive impairment is in itself a risk factor for the development of post-stroke delirium (Fong et al., 2006).

Delirium is a common behavioral disorder after acute stroke. Most studies of postoperative delirium was analyzed and mixed medical geriatric population, and few systematic studies of delirium is specific patients presented with stroke (Gustafson et al., 1991, Gustafson et al. 1993, Henon et al. 1991; Sandberg et al., 2001). Naughton et al. (1997) reported the results of 297 computerized tomographic scan findings in patients with acute delirium; 42 (15%) had one of the acute conditions (stroke, subdural hematoma, tumor). Of the patients with positive computerized tomography, all except two had a disorder of consciousness or new focal neurological deficit. Among the healthy elderly, infection and stroke are the most important etiological factors in delirium. Langhorne et al. (2000) found that the incidence of acute confused state among 311 patients with acute stroke is 36% with weekly prevalence of 24%.

For the purpose of this review, we used the search Pubmed to find all prospective studies of delirium in the acute stroke. The literature is limited; five studies have prospectively studied delirium post-stroke. The total number of patients evaluated in all the studies combined is 804 patients (Gustafson et al., 1991, 1992; Caeiro at al., 2004, Henon et al., 1999, Sheng et al., 2006). In these five studies, the incidence of delirium in the acute phase of stroke varied from 13% to 48% (Table 6).

Due to the specific problems and the complexity of diagnosis and therapy, there are specialized units for care of these patients (Wahlund, Gonzalez, 1999). Among patients with

Study	Gustafson *et al.*	Gustafson *et al.*	Henon *et al.*	Caeiro *et al.*	Sheng *et al.*
Year	1991	1993	1999	2004	2006
Country	Sweden	Sweden	France	Portugal	Australia
Population	Consecutive stroke patients	Consecutive ischaemic stroke patients	Consecutive stroke patients	Consecutive stroke patients	Consecutive stroke patients
Number of patients	145	83	202	218	156
Mean Age (range)	73 (40–101)	75 (44–89)	75 (42–101)	57.3 (24–86)	80 (65–95)
Diagnostic criteria	DSM-III-R	DSM-III-R	DSM-IV and DRS	DRS	DSM-IV
Frequency of assessments	Two assess-ments within first week	Before and after dexamethasone suppression test	Not specified	On admission	Within 3 days of admission
% Delirium	48	42	24	13	25

Table 6. Summary of prospective studies that have assessed post-stroke delirium, (McManus et al., 2007)

delirium in these classes about 40% had dementia, 30% mild cognitive deficit, and 14% depression. It should be keep in mind that the large number of cases of dementia and delirium requires etiological clarification.

Traditionally, delirium has been regarded as having a good prognosis with complete recovery if the underlying cause can be reversed. In addition, delirium was felt to be a short-lived syndrome. Both these assumptions are being increasingly challenged. In studies of patients following hip replacement surgery, delirium is independently associated with poor functional outcome, death and institutionalisation (Marcantonio et al., 2000).

In older patients, delirium is an independent risk factor of sustained poor cognitive and functional status during the year after a medical admission (McCusker et al., 2003). It is also an independent marker for increased mortality at discharge and at 12 months post-discharge, for increased length of stay and institutionalisation (Siddiqi et al., 2006).

There are few data on the outcome of delirium post-stroke, in particular the long-term sequelae. Only one report has 12 months follow-up data (Sheng et al., 2006). The data that are available are summarised in Table 7 and indicate similar prognostic associations to those found in other clinical trials.

Study	Year	Time period	Outcome
Gustafson et al.	1991	Up to discharge	Increased length of stay in patients with delirium (19 versus 13 days, $P<0.001$)
			Increased institutionalisation in patients with delirium (52% of delirious patients institutionalised compared with 15% of non-delirious group)
			Increased need for rehabilitation for delirious patients ($P<0.004$)
			Increased mortality in patients with delirium on admission (11 of 13 deaths occurred in delirium group
Gustafson et al.	1993	Up to discharge	Increased mean length of stay in delirious patients (23.1 versus 15.6 days, $P<0.005$)
			Delirious patients had higher post dexamethasone suppression test cortisol levels ($P<0.001$)
Henon et al.	1998	Up to discharge, in addition 6 month mortality and functional status	Delirious patients had increased length of stay ($P<0.05$), worse functional outcome at discharge ($P<0.001$) and at 6 months ($P<0.001$), lower MMSE score at 6 months ($P<0.002$) but no increase in mortality on discharge ($P = 0.828$) or at 6 months ($P = 0.38$)
Caeiro et al.	2004	Up to discharge	Delirious patients more likely to be dead or dependent ($P = 0.0001$)
Sheng et al.	2006	Up to discharge, 6 and 12 month data on mortality, MMSE, Functional Independence Measure (FIM)	Delirious patients had increased 6 month mortality ($P = 0.02$), increased 12 month mortality ($P = 0.002$) lower MMSEs at 1 month ($P<0.01$) and 12 months ($P<0.01$), lower FIMs at 1, 6 and 12 months ($P<0.01$, $P = 0.003$ and $P = 0.003$ respectively) and increased institutionalisation ($P = 0.002$)

Table 7. Outcome of patients with delirium, (McManus et al., 2007)

Delirium post-stroke is associated with increased length of stay, increased in-patient mortality, increased risk of institutionalisation, increased need for geriatric rehabilitation, increased dependence on discharge and at 6 months, lower MMSE at 6 months and at 12 months, and higher 6 and 12 months mortality rate (Gustafson et al., 1993; Sheng et al., 2006; Henon et al. 1998; Caeiro et al., 2004).

One of the features of delirium is that it is a reversible disorder. In small number of cases is worsening with the development of coma, convulsions and potentially death. Patients may recover completely, to stay with certain consequences, or the recovery of dementia observed that previously existed. In case of patients with various somatic disorders, delirium forecast is largely conditioned by the underlying disease. Elderly patients who develop delirium during hospitalization have a mortality rate of 22% to 76% (Cameron et al., 1987). Increased mortality was documented after discharge from hospital and it was about 25% during the first six months (Trzepacz et al., 1985).

Delirium in patients with stroke is associated with poorer functional but not vital prognosis at discharge and after six months. Patients with stroke and symptoms of delirium have a longer duration of hospital stay and increased incidence of vascular dementia (Gustafson et al., 1991; Henon et al., 1999). Association of delirium with dementia was seen in 8% to 43% depending on the test population (Bucht et al., 1999). In the elderly, mortality due to delirium range from 10% to 75%. In about 20% of patients after cessation of acute confused state, the residues can be identifying up to 6 months later (Hill et al., 1992). These are the most common variety of cognitive deficits. These disorders may be a prelude to the forthcoming dementia. Perhaps that is a critical factor in remaining cognitive reserve. The risk of dementia after delirium in the elderly over 65 years is about 60%, with an annual incidence of 18.1% (Rockvod et al., 1999).

To date, there have been no studies that have evaluated either the prevention or the management of post-stroke delirium. Up to one-third of delirium cases are preventable in medical wards. Inouye et al. (1999) found that a multi-component intervention targeting cognitive impairment, sleep deprivation, immobility, visual and hearing impairment and dehydration reduced the incidence of delirium from 15% in the control group to 9.9% in the intervention group.

With regard to established delirium, the recent guidelines from the Royal College of Physicians give a useful overview of the important aspects of delirium management (Anonymous, 2006). The most important action is the treatment of the underlying cause — this may be the stroke or it may be a complication post-stroke, for example, infection. The patient should be nursed in a good sensory environment and sedation should be used sparingly. Haloperidol is the drug of choice if sedation is needed although the evidence-base for this is weak (Lonergan et al., 2007). Prevention of complications resulting from the onset of delirium — for example, pressure sores and malnutrition — is extremely important. It is entirely conceivable that a multi-component intervention programme that involves training of the stroke unit staff could reduce the incidence of delirium post-stroke and improve the management of established delirium.

5. Conclusion

The main contribution of our research is that we confirm the significance of individual risk factors for delirium after stroke, and previous studies that have been identified and that we have found and new factors not previously been identified. We came to the conclusion that

the high body temperature, neutrophilia, leukocytosis, increased sedimentation and aspartatamniotransferasis, previous chronic diseases and older age were possible precipitating factors for delirium in the acute phase of stroke.
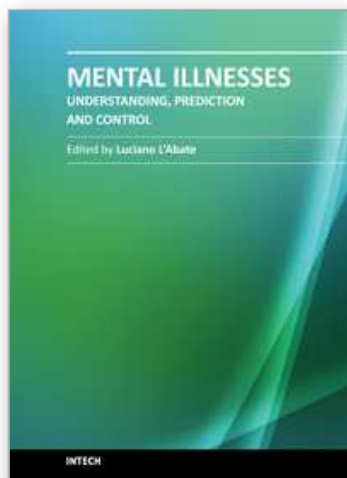
Delirium is a common complication after stroke and is independently associated with increased mortality and morbidity. There is a need for more research to clarify the incidence, the predisposing and precipitating factors, and the prognosis in the stroke setting. It seems clear that delirium is a poor prognostic indicator in patients with acute stroke. What is less clear is whether this is because of the underlying stroke type or whether it is by itself an independent marker of poor outcome after stoke. More research is also needed to evaluate preventative and therapeutic strategies in the stroke setting.

It is unclear what the best screening tool is for delirium in the acute stroke setting or how often patients should be screened for delirium. Most screening tools for delirium require a patient who is able to speak. All stroke units should have protocols for screening for delirium, managing patients with established delirium and for preventing delirium in high-risk patients.

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In the book "Mental Illnesses - Understanding, Prediction and Control" attention is devoted to the many background factors that are present in understanding public attitudes, immigration, stigma, and competencies surrounding mental illness. Various etiological and pathogenic factors, starting with adhesion molecules at one level and ending with abuse and maltreatment in childhood and youth at another level that are related to mental illness, include personality disorders that sit between mental health and illness. If we really understand the nature of mental illness then we should be able to not only predict but perhaps even to control it irrespective of the type of mental illness in question but also the degree of severity of the illness in order to allow us to predict their long-term outcome and begin to reduce its influence and costs to society. How can we integrate theory, research evidence, and specific ways to deal with mental illness? An attempt will be made in the last conclusive chapter of this volume.

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