Original Article

Prevalence of Dementia among Elderly Surgical Patients using Thai Modified IQ CODE: A Cross-Sectional Study

Puriwat To-adithep MD[1], Titima Wongviriyawong MD[2], Chayanan Thanakiattiwibun Msc[3], Mellada Chanidnuan MD[1], Worapat Pancharoen MD[1], Onuma Chaiwat MD[1]

[1] Department of Anesthesiology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand
[2] Department of Medicine, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand
[3] Integrated Perioperative Geriatric Excellent Research Center, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand

Objective: To identify the prevalence of dementia among elderly surgical patients and to compare the postoperative complications, length of hospital stays and mortalities.

Materials and Methods: Elderly surgical patients aged over 60 both in the surgical intensive care units (SICUs) and the general surgical wards were enrolled in the study, between March 2015 and July 2016. Dementia was assessed by using the Thai version of the Modified Informant Questionnaire on Cognitive Decline in the Elderly (Modified IQ CODE).

Results: Out of 427 participants, 169 (39.6%) were admitted to SICUs, while 258 (60.4%) were admitted to wards after their operations. The overall prevalence of dementia found in this study was 13.1%; the prevalence was 9.5% in the critically ill patients and 15.5% in the general surgical patients. The participants with dementia were significantly older than the non-dementia patients (77.3±7.4 vs. 74.0±7.8 years, p = 0.003). The incidence of postoperative delirium was statistically significantly higher among those patients who had pre-operative dementia than those who had no dementia (46.4% vs. 16.7%, p<0.001). The adverse events, including hospital events, nosocomial infection rates, hospital mortalities, and hospital length of stay did not significantly differ between the dementia and non-dementia patients.

Conclusion: The prevalence of dementia among the elderly surgical patients was 13.1%, similar to the findings of other studies in the same population. The prevalence was higher among older patients, and the incidence of postoperative delirium was significantly higher for patients with pre-existing dementia.

Keywords: Dementia, Elderly surgical patients, Modified IQ CODE

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Dementia is the general term for a decline in mental ability that interferes with daily life. It can affect several functions, not only memory, but also learning, language, comprehension, attention and judgement. These disturbances might impact routine activities and daily rounds, resulting in a dependency state[1]. There are several causes of dementia: Alzheimer's disease is the most common (54%), followed by vascular dementia (16%), Lewy body dementia (10%) and Parkinson disease (4%)[2-5].

Dementia is a common problem among the elderly. It is likely to increase with the steady global growth of elderly people, and there are signs that the number of patients who suffer from dementia is escalating rapidly[2,3]. Currently, age-standardized prevalence of dementia for those aged ≥60 are 5 to 7% in most world regions[6]. It has been estimated that 35.6 million people lived with dementia worldwide in 2010, with the figure expected to almost double every 20 years, to 65.7 million in 2030 and 115.4 million in 2050[1,6,7]. In one study from the United States of America, the prevalence of dementia was reported as being 13.9%

Correspondence to:
Chaiwat O. Department of Anesthesiology, Faculty of Medicine Siriraj Hospital, Mahidol University, 2 Wanglang Road, Bangkoknoi, Bangkok 10700, Thailand.
Phone: +66-2-4197978, **Fax:** +66-2-4113256
E-mail: onuma27@hotmail.com

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among individuals aged 71 and older, and increasing with age[2].

The prevalence of dementia in Southeast Asia who are older than 60 ranges up to 6.38%[6]. In Thailand, the prevalence was about 3.3% of the population (95% confidence interval; 2.7 to 3.8)[8]. The figure was much higher among patients who were admitted to hospitals, especially in the case of critically ill patients; in medical intensive care unit [ICU], moderate to severe dementia was observed in approximately 17% of patients, based on the Modified Blessed Dementia Rating Scale[9]. However, information regarding the prevalence of dementia among Thai elderly surgical patients is limited. Muangpaisan et al reported a prevalence of 17.5% among patients undergoing hip fracture surgical treatment[10].

Generally, elderly patients undergoing operations under anesthesia are at risk of developing early and late postoperative cognitive dysfunction by an unknown mechanism[11,12]. Patients with dementia have a higher likelihood of developing postoperative delirium. In addition, they are admitted to hospital with other illnesses are often not diagnosed with, or treated for, dementia. Recently, three potential cognitive screening tests for dementia are the Mini-Mental State Examination [MMSE], the Thai Mental State Examination [TMSE], and the Modified Informant Questionnaire on Cognitive Decline in the Elderly [Modified IQ CODE]. Investigators decided to use Modified IQ CODE to assess the extent of dementia among Thai elderly surgical patients. The advantages of this tool include its simplicity and its pragmatic detection of cognitive changes that might represent major symptoms of dementia[13].

The objectives of this study were firstly, to identify the prevalence of dementia and, secondly, compare the postoperative complications, the lengths of hospital stay and the mortality rates of elderly surgical patients with and without dementia.

Materials and Methods

This research was a descriptive cross-sectional study. After approval by the Siriraj Institutional Review Board (Si. 718/2015), Faculty of Medicine, Siriraj Hospital, Mahidol University, data collection was performed between March 2015 and July 2016 at the surgical ICUs [SICUs] and general surgical wards of Siriraj Hospital. The authors enrolled all elderly surgical patients aged over 60. The exclusion criteria were patients undergoing neurosurgery, cardiovascular and thoracic surgery; patients with major depressive disorders which might affect the interpretation of the Modified IQ CODE; no caregiver available to give information; and patients who declined to provide written informed consent; patients who could not communicate in Thai; patients admitted in SICUs less than 12 hours or Richmond Agitation-Sedation Scale [RASS] -4, -5 all 7 days after operation. In order to obtain that consent, the researchers provided the patients and their relatives and/or proxies with information about the study objectives and procedures, and the benefits of participating in the present study. The Thai version of the Modified IQ CODE was used to assess the cognitive function changes of the elderly patients over the preceding 10-year period by asking their caregivers for information.

The Thai version of the Modified IQ CODE is a simple test for the early detection of dementia in elderly patients. In the study, the tool was used to assess the cognitive changes in the elderly patients by asking their informants (i.e., relatives who had lived with them for over 10 years) about those aspects of the patients'everyday cognitive functioning that are associated with dementia. The test consists of 32 items. Dementia was suspected if the average score of the Modified IQ CODE was $\geq$3.42 (90% sensitivity, 95% specificity, a positive predictive value of 94%, a negative predictive value of 90%, and 92% accuracy)[13]. Delirium was assessed by using the Thai version of the Confusion Assessment Method for the Intensive Care Unit [CAM-ICU] for critically-ill patients, which has demonstrated high sensitivity and reliability for the diagnosis of delirium in the ICU[14]. The fifth edition of the Diagnostic and Statistical Manual of Mental Disorders [DSM-5] was used by experienced geriatricians to identify delirium in the general surgical ward patients[15].

Demographic variables were obtained from medical records and by interviewing the caregivers. The information related to age, sex, comorbid diseases, cigarette and alcohol consumption, the American Society of Anesthesiologist [ASA] classification, and the types and sites of surgery. The research assistants were trained to use the Thai version of the Modified IQ CODE. Post-operative complications were identified; for example, delirium, nosocomial infections and hospital events, such as self-extubation and the self-removal of catheters. Details of the periods in the SICUs, the lengths of hospital stay, and a number of mortalities were also recorded.

The primary outcome was the prevalence of dementia among elderly surgical patients. The

secondary outcomes related to the incidences of postoperative clinical complications, hospital events and mortalities.

Statistical analysis

The present study aimed to establish the prevalence of dementia among elderly surgical patients aged 60 or older. A previous study showed that the prevalence of dementia among Thai elderly surgical patients at Siriraj Hospital was 17.5% (the error was 0.04, and the confidence interval [CI] was 0.95)[10]. A sample size of 347 patients was calculated using the mobile phone application, n4Studies version 1.4.1. Once an estimated 20% loss was added, the total number of participants required was determined to be 416.

Statistical analyses were calculated using SPSS Statistics for Windows, version 18.0 (SPSS Inc., Chicago, Ill., USA). Demographic data and clinical variables were summarized using descriptive statistics. Continuous data were reported as means and standard deviations (or medians with minimum and maximum, as appropriate), while categorical data were reported as frequencies and percentages. Comparisons between the groups were performed with the independent-samples t-test, the Mann-Whitney U test, the Chi-squared test or Fisher's exact test, as appropriate. A *p*-value of <0.05 was considered statistically significant.

Results

The 594 Thai elderly surgical patients admitting to Siriraj Hospital between March 2015 and July 2016 were enrolled and screened for dementia using the Thai Modified IQ CODE. Sixty- three patients were excluded from the study due to surgery cancellations, leaving 427 for inclusion in the analyses (Figure 1). One hundred and sixty-nine patients (39.6%) were admitted to SICUs, while 258 (60.4%) were admitted to general wards after the operations. Consequently, 56 patients (13.1%) were diagnosed with dementia, with 9.5% of the critically ill patients and 15.5% of the general surgical patients suffering from this condition.

The participants with dementia were significantly older than the non-dementia patients as

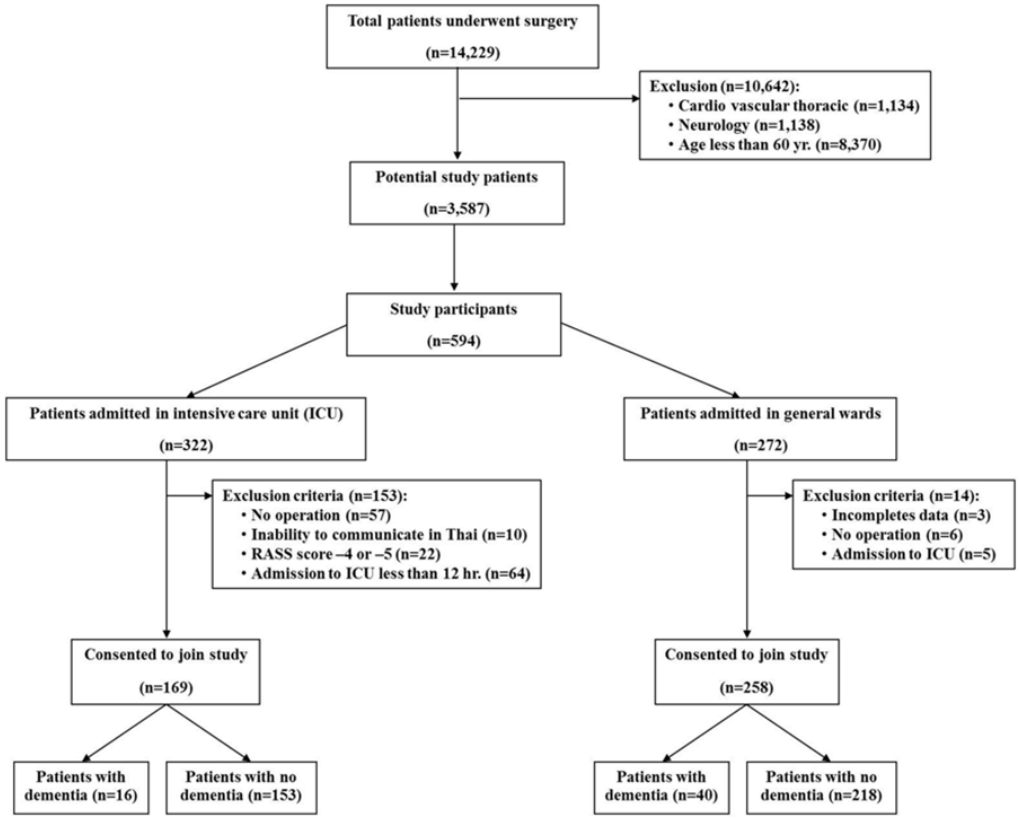

Figure 1. STROBE Flow diagram.

77.32±7.35 vs. 74.02±7.78 years (p = 0.003). The age specific prevalence ranged from 3% to 20%, showing an increase with advancing age (Figure 2).

Apparently, there was no significant difference between the dementia and non-dementia patients for all comorbid diseases (p>0.05). Most patients in this study had at least one comorbid disease: namely, hypertension (73.8%), dyslipidemia (41.0%) and diabetes mellitus (31.6%). Smoking history (17.9% vs. 26.8%) and alcohol consumption (28.6% vs. 21.3%) were not significantly different between the two groups. The majority of subjects underwent orthopedic surgery or colorectal surgery. Half of the participants were classified as ASA III (50.8%); the ASA classifications were not significantly different between the two groups. The incidences of postoperative delirium (defined by CAM-ICU) among critically ill patients and general surgical patients (defined by DSM-5) were significantly higher in patients with preoperative dementia than those without dementia (46.4% vs. 16.7%; p<0.001).

The adverse events including the hospital events and nosocomial infection rates between the two groups showed no any significant difference. The median lengths of hospital stay were 8 and 9 days for the dementia and non-dementia groups, respectively (p = 0.217). The hospital mortality rate of the dementia group was not significantly higher than the other (7.1% vs. 5.1%; p = 0.524) (Table 2).

Discussion

The study demonstrated that the overall prevalence of dementia among the Thai elderly surgical patients at Siriraj hospital was approximately 13.1%. The prevalence also showed an increase among older age groups and the patients with dementia were significantly older than non-dementia patients. The incidence of postoperative delirium was higher among dementia patients than non-dementia patients.

Other studies have demonstrated a prevalence of dementia in the Thai population of between 1.8% and 10.2%, and have confirmed that the proportion of people suffering from this condition increases with advancing age. These rates are comparable with studies in other countries[8,17,18].

In present study, the majority of the patients (33.5%) underwent orthopedic surgery. As mentioned, Muangpaisan et al reported a prevalence of dementia of 17.5% in hip-fracture patients[10] while Mosk et al reported a prevalence of dementia of 29.7% among patients aged ≥70 years who underwent orthopedic surgery[23]. Both studies showed a higher prevalence of dementia than the present study. However, those two studies employed a retrospective study design, and their information was obtained from medical

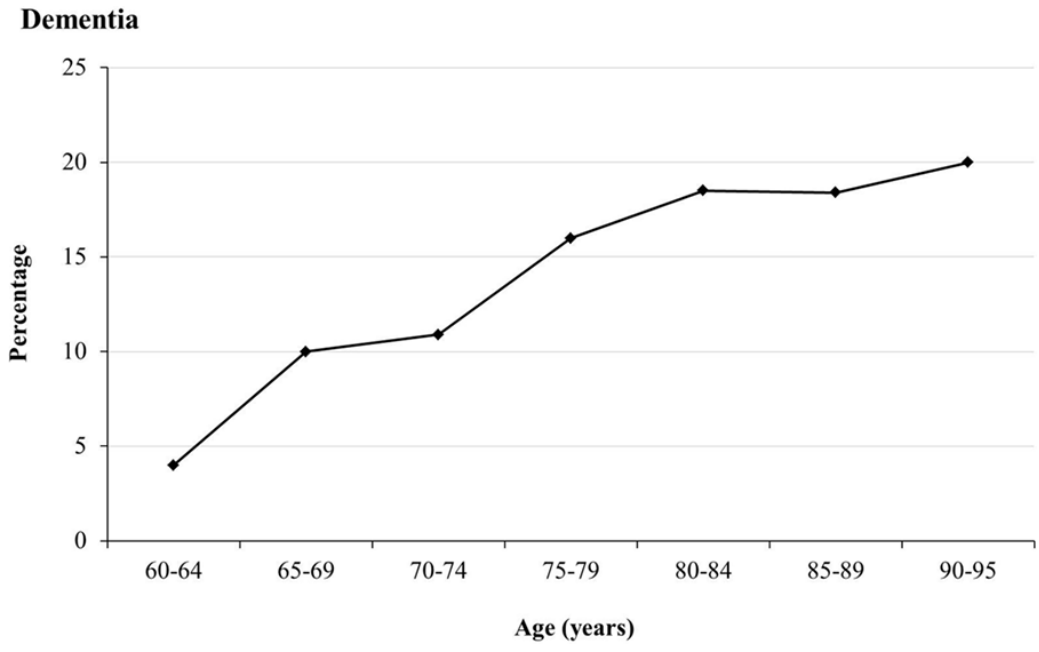

Figure 2. Age-specific prevalence of dementia among Thai elderly surgical patients at Siriraj Hospital.

Table 1. Demographic data

	Total (n = 427)	Dementia (n = 56)	Non-dementia (n = 371)	*p*-value
Age (year)	74.5±7.8	77.3±7.4	74.0±7.8	0.003*
Gender: female	245 (57.4)	33 (58.9)	212 (57.1)	0.885
Comorbid diseases				
Previous stroke	44 (10.3)	9 (16.1)	35 (9.4)	0.154
Diabetes mellitus	135 (31.6)	22 (39.3)	113 (30.5)	0.217
Hypertension	315 (73.8)	44 (78.6)	271 (73.0)	0.420
CKD or ESRD	79 (18.5)	10 (17.9)	69 (18.6)	1.000
Cirrhosis	15 (3.5)	2 (3.6)	13 (3.5)	1.000
Cardiac disease	102 (23.9)	11 (19.6)	91 (24.5)	0.503
Dyslipidemia	175 (41.0)	16 (28.6)	159 (42.9)	0.057
Site of surgery				0.733
Gastrointestinal tract	133 (31.1)	15 (26.8)	118(31.8)	
Vascular	48 (11.2)	5 (8.9)	43 (11.6)	
Extremities/spine	143 (33.5)	17 (30.4)	126 (34.0)	
Thoracic	16 (3.7)	3 (5.4)	13 (3.5)	
Head neck and breast	33 (7.7)	6 (10.7)	27 (7.3)	
OB-GYN	8 (1.9)	0	8 (2.2)	
Skin/soft tissue	9 (2.1)	2 (3.6)	7 (1.9)	
Other	37 (8.7)	8 (14.3)	29 (7.8)	
ASA classification				0.585
II	181 (42.4)	25 (44.6)	156 (42)	
III	217 (50.8)	29 (51.8)	188 (50.7)	
IV	29 (6.8)	2 (3.6)	27 (7.3)	
Hospital stay				0.079
ICU	169 (39.6)	16 (28.6)	153 (41.2)	
Non-ICU (ward)	258 (60.4)	40 (71.4)	218 (58.8)	
Type of surgery				1.000
Elective	360 (84.3)	47 (83.9)	313 (84.4)	
Emergency	67 (15.7)	9 (16.1)	58 (15.6)	

The data are presented as mean ± standard deviation or n (%)
* $p<0.05$ indicates statistical significance
CKD = Chronic kidney disease; ESRD = End-stage renal disease; OB-GYN = Obstetrics and gynecology; ASA = American Society of Anesthesiology; ICU = Intensive care unit; SD = Standard deviation

records. In addition, their populations were hip-fracture patients undergoing surgical intervention: this category of patients is known to have a high prevalence of dementia[10,19]. In contrast, our study was a prospective study design, which recruited patients of all surgical types and sought information directly from the patients' caregivers to make a diagnosis of dementia using the Modified IQ CODE tool.

Not surprisingly, our data confirmed that the age of dementia patients was significantly higher than non-dementia patients. The age-specific prevalence rates in the present study (Figure 2) were higher with increasing age. Those results did not differ from other studies of different population groups around the world[2-4,8].

The elderly patients in our study had multiple comorbid diseases, the three most common were hypertension, dyslipidemia [DLP] and diabetes mellitus [DM]. Beatriz Poblador-Plou et al reported the similar results, namely, that the two most frequent comorbid diseases in dementia patients were hypertension and DM[20]. Hu et al reported that dementia patients had a significantly higher number of comorbid diseases than non-dementia patients; they included hypertension, chronic obstructive pulmonary diseases, myocardial infarction, DM and stroke[21]. However, our study did not show a significant difference in the incidences of the comorbid diseases of the dementia and non-

Table 2. Outcome variables

	Total (n = 427)	Dementia (n = 56)	Non-dementia (n = 371)	*p*-value
Postoperative used of mechanical ventilation	126 (29.5)	11 (19.6)	115 (31.0)	0.086
Postoperative delirium	88 (20.6)	26 (46.4)	62 (16.7)	<0.001*
Hospital events				
Self-extubation	9 (2.1)	2 (3.6)	7 (1.9)	0.335
Self-remove IV catheter	0 (0)	0 (0)	0 (0)	N/A
Self-remove foley catheter	11 (2.6)	2 (3.6)	9 (2.4)	0.644
Nosocomial infection				
Pneumonia	17 (4.0)	4 (7.1)	13 (3.5)	0.258
Urinary tract infection	6 (1.4)	0 (0)	6 (1.6)	1.000
CRBSI	0 (0)	0 (0)	0 (0)	N/A
Surgical site infection	6 (1.4)	0 (0)	6 (1.6)	1.000
Sepsis	5 (1.2)	1 (1.8)	4 (1.1)	0.507
Length of hospital stay (days)	9 (5, 17)	8 (4, 15)	9 (5, 17)	0.217
Hospital mortality	23 (5.4)	4 (7.1)	19 (5.1)	0.524

The data are presented as median [IQR] or n (%)
* $p<0.05$ indicates statistical significance
CRBSI = Catheter-related blood stream infection; IV = Intravenous; N/A = Not applicable

dementia patients. The sample size of this study was calculated to determine the prevalence of dementia; the size might therefore have been insufficient to also identify the risk factors associated with dementia.

The present study demonstrated that postoperative delirium [POD] was significantly more common among the dementia patients than the non-dementia patients (46.4% vs. 16.7%; $p<0.001$). Several studies have reported similar results. Robinson et al used a multivariable logistic model to show that dementia was the strongest predictor of POD[22]. Mosk et al also reported that patients with dementia had a higher incidence of POD, and that dementia was an independent risk factor for POD[19].

Patients with dementia have a poor prognosis with potentially serious consequences, and a higher risk for clinical complications such as pneumonia, septicemia, malnutrition and falls[10,21,23,24]. Hu et al showed that dementia patients face a higher risk of postoperative complications during hospitalization, including acute kidney injuries (OR 1.32, 95% CI 1.19 to 1.7), pneumonia (OR 2.18, 2.06 to 2.31), septicemia (OR 1.8, 1.69 to 1.92), strokes (OR 1.51, 1.43 to 1.6) and urinary tract infections (OR1.62, 1.5 to 1.74)[21,22]. Tsuda et al demonstrated that the incidence of postoperative complications such as surgical site infections, urinary tract infections and respiratory complications are higher in patients with pre-operative dementia after hip-fracture surgery[25]. In contrast with our study, the incidences of postoperative events and the nosocomial infection rates were not significantly higher among the dementia patients. This could be because the present study's sample size was too small to detect a clear differentiation between the postoperative complications of the two groups. However, it is possible that shorter lengths of hospital stay, even with the same ASA classifications as in previous studies, may lead to fewer postoperative complications and events[21].

The hospital mortality rate of the dementia patients (7.1%) in the present study was not significantly higher than that for the non-dementia patients (5.1%; $p = 0.524$). This corresponds with the findings of a study by Pisani et al[9], which documented that there were no differences in the hospital mortality rates of older patients with and without dementia in an intensive care unit. Nevertheless, that study reported a higher overall hospital mortality rate (25%) than the present study (5.4%) because all critically ill patients (*i.e.*, not just those aged over 60 years) were studied[9].

Some limitations of the present study should be addressed. Firstly, despite knowing that DSM-5 is the gold standard for diagnosing dementia, we had limited resources to assess dementia with DSM-5, so data on the severity of the dementia were not included. Instead of DSM-5, the Modified IQ CODE was used; it has been shown to have a high sensitivity and

specificity[13]. Secondly, the information for diagnosing dementia might not be very accurate because some relatives who were asked to give information on the patients could not recall all of the required information. Thirdly, the sample size was too small to demonstrate a significant difference in the secondary outcomes, including postoperative events and nosocomial infections. Finally, some relevant information during the pre-operative and intra-operative periods was not obtained, for example, the patients' education levels, the caregivers' roles, details of intra-operative events, the duration and types of anesthesia, and the medications used.

Further research should focus on how to detect dementia early and on the development of an implementation protocol to reduce the incidence of postoperative complications, such as delirium in patients with pre-existing dementia.

Conclusion

The prevalence of dementia among Thai elderly surgical patients was 13.1%. The incidence of postoperative delirium was also significantly higher among patients with pre-existing dementia. Other postoperative complications, including hospital events, length of stay and hospital mortality, showed no significant difference between patients with and without dementia.

What is already known on this topic?

The prevalence of dementia is higher among older patients. The majority of patients with dementia are older than non-dementia patients. Pre-existing dementia is associated with postoperative delirium.

What this study adds?

The present study demonstrated that the prevalence of dementia among Thai elderly surgical patients at Siriraj Hospital was 13.1%. The incidence of postoperative delirium was significantly higher among dementia patients than non-dementia patients.

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Potential conflicts of interest

The authors declare no conflict of interest.

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Appendix 1. Thai version of Modified IQ CODE

	การเปลี่ยนแปลงระหว่าง 10 ปีที่แล้วกับปัจจุบัน				
	ดีขึ้นมาก (1)	ดีขึ้นเล็กน้อย (2)	ไม่เปลี่ยนแปลง (3)	แย่ลงเล็กน้อย (4)	แย่ลงมาก (5)
1. ความจำเกี่ยวกับหน้าตาคนในครอบครัวหรือญาติ					
2. ความจำเกี่ยวกับชื่อคนในครอบครัวหรือญาติ					
3. ความจำในรายละเอียดของคนในครอบครัวหรือญาติเกี่ยวกับอาชีพ ที่อยู่					
4. ความจำในเหตุการณ์ที่เกิดขึ้นเมื่อ 2-3 วันที่ผ่านมา					
5. ความจำในเรื่องที่สนทนาไปเมื่อ 2-3 วันที่ผ่านมา					
6. พูดคุยอย่างต่อเนื่องโดยไม่ลืมสิ่งที่จะพูด					
7. จำได้ว่าตอนนี้พักอาศัยอยู่ที่ไหน					
8. จำได้ว่าวันนี้เป็น วัน เดือน อะไร					
9. ความจำเกี่ยวกับที่ประจำที่ใช้เก็บของในบ้าน					
10. จำได้ว่าวางของไว้ที่ไหน					
11. จำเหตุการณ์เกี่ยวกับตนในวัยเด็ก					
12. จำสิ่งที่ตนได้เรียนรู้ในวัยเด็ก					
13. ทราบเหตุการณ์ที่สำคัญในอดีต					
14. ความสามารถในการปรับตัวเข้ากับการเปลี่ยนแปลงในชีวิตประจำวัน					
15. สามารถใช้เครื่องมือที่คุ้นเคยภายในบ้าน					
16. สามารถเรียนรู้การใช้เครื่องมือ เครื่องใช้ใหม่ๆ ในบ้าน					
17. สามารถเรียนรู้สิ่งใหม่ ๆ ทั่ว ๆ ไป					
18. สามารถเข้าใจความหมายของคำแปลก ๆ					
19. สามารถเข้าใจบทความในหนังสือพิมพ์หรือนิตยสาร					
20. สามารถติดตามเรื่องราวต่างๆ ในวิทยุ หรือโทรทัศน์					
21. สามารถติดต่อลูกหลาน ญาติหรือกิจธุระทั่วๆ ไป					
22. ความสามารถในการตัดสินใจเรื่องต่างๆ ในชีวิตประจำวัน					
23. ความสามารถในการใช้จ่าย					
24. ความสามารถในการจัดสรรเรื่องเงิน					
25. สามารถประมาณได้ว่าจะใช้สิ่งของประมาณเท่าไร เช่น จะซื้ออาหารเท่าไร หรือกะเวลาที่ใช้ในการทำกิจกรรมต่างๆ เช่น ใช้เวลาในการเดินทางเท่าไร					
26. สามารถที่จะเข้าใจในสิ่งที่เกิดขึ้น พร้อมกับให้เหตุผลในสิ่งนั้นได้					
27. สามารถร้องเพลงที่เคยร้องหรือสวดมนต์ที่เคยสวด					
28. สามารถเลือกใช้เครื่องมือเครื่องใช้ต่างๆ ได้อย่างเหมาะสมกับงาน					
29. การพูดจาหรือถามซ้ำๆ					
30. สามารถปฏิบัติกิจวัตรประจำวันของตนเอง					
31. สามารถเดินทางไป-กลับสถานที่ที่คุ้นเคยได้โดยลำพัง					
32. สามารถทำงานที่เคยทำ					