5 Discussion

5.1 Key findings of the present study

5.1.1 The prevalence of dementia was higher than in population-based sample

In a total number of 4882 patients treated in the EGZB during 2003 to 2004, the prevalence of dementia was 18.97% (871 valid dementia cases). This prevalence figure was higher than in most population-based studies. The majority of results of epidemiological studies showed that the prevalence of dementia is generally around 5% to 20% in people aged 65 years and older [4, 21], and 7.3% for women, 4.5% for men in Germany [148]. As reviewed, the results of studies on dementia varied by characteristics of samples, especially with regard to the prevalence rates. If a study is based on a sample of geriatric hospitalized patients, it is clear that the prevalence of dementia would be higher than in a population-based study. The result of present study was consistent with most of the scarce previous studies on hospitalized patient samples, indicating that the prevalence of dementia in general medical services ranges from 15% to 35% [138-140]. Hickey et al. reported that the prevalence of dementia in an acute general hospital was 22.3%-31% [139]. Joray et al. reported that cognitive impairment affected more than 32.3% of medical inpatients [138]. Mecocci et al. reported that the prevalence of cognitive impairment in medical inpatients was 27% [140]. Sahadevan et al. reported that the prevalence of dementia in the Department of Geriatric Medicine was 16.1% [68]. And Hendrie's review showed that the prevalence of dementia in a nursing home reached up 46% to 78% [11]. So the accurate prevalence of dementia can be defined only if a study is based on a population of sufficient size.

5.1.2 Vascular dementia was more prevalent in the present study

26.3% of 871 cases were characterized by Alzheimer's disease (AD), 34.0% by vascular dementia (VD), 39.7% by dementia syndromes (DS). The ratio of VD to AD was 1.29; this was not consistent with the average ratio of 0.7 derived from studies in the United States and Europe [68,141]. Compared with most western population-based studies, the Italian researcher Di Carlo et al. reported that 53% of all dementia cases were AD and 27% was VD cases [134], and the German researcher Fratiglioni et al. reported that the prevalence of AD was 0.9% and the prevalence of VD was 0.3% [149]. The percentage of VD in the

present sample was considerable higher, which reflects the fact that patients with stroke are more likely to be hospitalized. This result was supported by another study of hospitalized sample, which documented that the percentage of VD reached 55% and AD 40% [68]. It is reported that the average ratio of VD to AD in Asian epidemiology studies of dementia was 1.6 [141]. Additionally, in the present study the percentage of DS was higher than in most studies published in literatures due to the fact that our group included all other types of dementia cases and some cases with advanced dementia of unknown origin. Most patients in the DS subgroup were fairly old, suffered from severe dementia, immobility, severe basic ADL dependency and were institutionalized. Some of them were in a poor or terminal medical stage, which made further diagnosis impossible. This result reflected the situation that for those patients with dementia in the advanced stage, it is very difficult to make a differential diagnosis of subtype of dementia. Further studies to investigate the actual distribution of dementia subtype in geriatric hospitals are needed.

5.1.3 The majority of patients with dementia in the present study were very old

Descriptive statistical analysis showed that the average age of patients with dementia in the present study was 82.00±8.2 years, and 67.7% (n=590) cases aged 80 years and older. The median age was 83 years. This indicated that patients with dementia in the present study were fairly old due to the selected sample derived from a geriatric hospital. This result was supported by several studies of hospitalized samples, which reported that 80% of patients with dementia were 75 years and above in a geriatric department [68] and the average age was 80.05±6.95 [63] and 80.18±8.15 [66] in memory clinics. Present results further supported that dementia is an age-related disease. Older age was a risk factor to develop dementia.

5.1.4 Comorbidity number was very high in the present study and vascular-related disease was more prevalent

Literature reviews showed a variety of results on the comorbidity of patients with dementia and the exact prevalence of comorbidity in patients with dementia is unknown due to lack of standard measurements of comorbidity [130]. The present study showed that the average number of coexisting medical conditions reached 11.54±4.2. 96.1% (n=837) cases suffered from more than five medical conditions and 53.5% (n=466) cases suffered from more than ten medical conditions. This was much higher compared with an

American nursing home-based study (MDS), where the average number of clinically relevant diagnoses was 2.8±1.8 and 2.4±1.6 in the patients with moderate or severe cognitive impairment (average age 83.6±7.8 years, medical diagnosis by using ICD-9), compared with 3.0±1.9 in normal individuals [128]. However, in the present study comorbidity included both medical diseases and medical conditions according to German version ICD-10 due to the fact that both medical diseases and medical conditions are assigned the same importance in geriatric hospital practice. The higher number of coexisting medical conditions in the present study indicated that patients with dementia in a geriatric hospital suffered from multiple medical conditions. The most commonly coexisting diseases in the present study were vascular-related diseases such as heart disease, hypertension, stroke, diabetes, renal failure. This result was consistent with most of previous population-based studies and one study of hospitalized sample [14, 63,130,143]. In 2002, American survey using Medicare data to investigate the relationship between comorbidity and costs for AD and related dementia (ADRD) indicated that cerebro-vascular disease coexisted in 38.9%, congestive heart failure in 29.3%, myocardial infarction13.1%, diabetes 21% of the ADRD patients [143]. Bynum et al. found that 60.1% of patients with dementia had coexistent hypertension, 29.7% of patients had coexistent coronary artery disease, 27.8% had coexistent congestive heart failure, 24.7% had coexistent cardiac dysrhythmias and 21.2% of patients had coexistent diabetes [14]. Similar results were reported in Mok et al.'s study of a hospitalized sample, according to which, the most common comorbid diseases among AD subjects were hypertension, diabetes mellitus, and ischemic heart disease [63]. The higher percentage of stroke in the present study was related to the higher percentage of VD. Present results indicate that both degenerative vascular-related diseases and dementia are age-related diseases and commonly appear in geriatric patients. Vascular-related diseases shared the same risk factors and they were inter-related.

5.2 The functional status of patients with dementia in the present study

The functional status of patients with dementia in the present study was measured by using basic ADL (Barthel Index); instrumental ADL (IADL) was not used, as the majority of patients with dementia in this selected sample were severely disabled in instrumental ADL and most of them were at the bottom of the scale at the time of admission to the hospital. In order to reduce the impact of acute medical conditions on the functional status,

Barthel Index was used at the time of discharge. The Barthel Index score in the present study was scored by experienced hospital nurses according to the observed situations, with less credence being given to information provided by patients and caregivers, which made the assessment more objective and reliable. The results showed that the majority of patients with dementia in the present sample had a large range of functional deficits and serious basic ADL dependency. 56.3% of patients had moderate to severe cognitive impairment with MMSE scores of less than 18. 79.2% cases showed moderate to severe walking problem with more than 20 seconds needed for the TUG. 78.1% cases were at a higher risk of falls with Tinetti-Total scores of less than 18. The average BI score was 45.47±31.23, and 59.1% cases showed dependency in basic ADL with a BI sum score of less than 55. This result reflects the specificities of this sample that the majorities of patients with dementia in a geriatric hospital have serious basic ADL dependency due to advanced cognitive impairment, poor mobility, multiple comorbidities and very old age. Although most of previous studies consistently reported that the prevalence of functional disability in patients with dementia was higher than in cognitively normal elderly [37], the results derived from different studies were incomparable due to different scales and different methodologies used to measure functional disability. In the present study basic ADL dependency was defined as a summed score of BI less than 55, which means that the patients were dependent in at least three basic ADL tasks in terms of Barthel Index. This prevalence of basic ADL dependency was very high. This result provides evidence that basic ADL of patients with dementia in the geriatric hospital was associated with cognitive function, mobility, age, comorbidity and in the most cases they inter-relate and contribute to the severely impaired functional status of patients with dementia.

5.3 The relationship between cognition and functional status in the present study

The disablement process model applied to dementia provided a theoretical framework for understanding the contribution of cognitive function to functional disability; dementia is regarded as one of the main pathways leading pathology to impairments, functional limitations, and disabilities. Cognitive impairment contributes to functional limitations and disability in activities of daily living. Age and comorbidity as intra-individual factors could speed up the disablement process [26]. And Greiner et al. pointed out that there are three possible scenarios for the role that cognitive functions may play in the disablement process leading to loss of ADL independency. The first was a cognitive decline that

preceded ADL dependency. The second was a concomitant cognitive and functional decline following an acute condition. And the third was a cognitive decline due to normal aging [43]. Although the basic ADL of patients with dementia in the geriatric hospital was supposed to be largely impacted by comorbidity and very old age, however, cognitive function is still a dominant factor determining the functional status in patients with dementia.

5.3.1 Cognition was significantly associated with basic ADL (BI) in the present study

In the present study, descriptive statistical results showed that with increasing MMSE category, BI score decreased sharply (Table 5) and with increasing BI, MMSE category decreased (Table 4). Pearson partial correlation analysis after adjusted for potential confounders such as comorbidity, age, gender, GDS, hospital stay duration, medication use, which are generally considered to have an impact on the functional status of patients with dementia, revealed a significant correlation between MMSE category and BI ($r=-0.46$, $p=0.000$). Compared with population-based studies, Leckey et al. reported that MMSE was the best predictor of ADL performance in AD ($r= 0.69$, $p < 0.001$, mean age 78.6±5.5, mean MMSE 18.2±4.6) [62]. The correlation coefficient of MMSE category and BI in present study seems rather weak. However, the study of hospitalized sample conducted by Mok et al. showed that the correlation coefficient between MMSE and BI was 0.30, $p=0.002$ (mean age 80.05±6.95, mean MMSE 15.14±4.62) [63]. Additionally, in the present study, a large number of dementia cases failed to be assessed by MMSE due to the patients' critical or poor medical conditions. This could attenuate the relationship between MMSE and BI. Further multiple regression analyses indicated that MMSE category could be an independent predictor of BI. It alone could account for 20% of variance in BI. Even after comorbidity and age were entered into the model, the standardized coefficient ß of MMSE category increased (-0.46, $p=0.000$), the standardized coefficient ß of comorbidity was -0.19 ($p=0.000$) and the standardized coefficient ß of age was -0.07 ($p=0.042$). While if the mobility measurements are entered into the model, the ß of MMSE category decreased. This result showed that basic ADL is explained better by mobility measures than by cognitive measure (MMSE category). However, according to the theoretical framework of ADL proposed by Katz [56], mobility itself is a part of ADL. And basic ADL depends largely on mobility and some basic ADL tasks overlap with mobility. Present results were consistent with most of previous

population-based studies; cognitive function is one of the best predictors of functional status in patients with dementia [30-32, 38, 42-43, 62-63]. This result suggested that Barberger-Gateau et al.'s disablement process model applied to dementia is also suited for geriatric hospitalized patients with dementia. Although the functional status of the geriatric hospitalized patients with dementia was impacted by acute medical conditions and very old age, cognitive function is still a major factor determining the functional status in this selected group of patients. Cognitive impairment is a precondition, which could trigger functional limitations and disability.

5.3.2 Mobility is a basis of basic ADL (BI)

Mobility is a basis for patients with dementia to maintain the ability to perform basic activities of daily living independently and mobility itself consist of a part of basic ADL [56, 104, 109]. Diminished mobility as a physical dysfunctional outcome could directly result in basic ADL disability [53, 96]. In the present study, descriptive statistical results showed that all mobility measures, including walking ability, balance, and gait performance were closely associated with BI. BI decreased sharply with increasing TUG category. With increasing Tinetti-Total, BI increased. With increasing BI, Tinetti-Balance, Tinetti-Gait, Tinetti-Total increased and TUG category decreased. After adjustment for age, gender, comorbidity, GDS, hospital stay duration, medication use, Pearson partial correlation analyses revealed a moderate correlation between BI and TUG category, Tinetti-Balance, Tinetti-Gait, Tinetti-Total. Further multiple regression analyses revealed that TUG category and Tinetii-Total can be an independent predictor of BI, respectively. TUG category alone could account for 41.0% of BI and Tinetti-Total could account for 58.0% of BI, even after age and comorbidity were entered into the analysis model, the standard coefficient remains unchanged. This result indicated that the mobility of patients with dementia in a geriatric hospital was closely associated with basic ADL (BI). The ability to perform basic ADL in these patients depends largely on mobility, which was mainly affected by cognitive impairment, comorbidity (organic impairment) and very old age. Present result was consistent with most previous population-based studies. Park et al. reported that the physical activities of daily living of elderly people could be related mainly with motor function of the limbs and severity of dementia (correlation of Motoricity Index and BI, $r=0.65$, $p<0.001$, mean age 75.6 ± 8.1) [53], and Waite et al. found that the different levels of disability in patients with dementia are related to the different patterns of

motor dysfunction [104], and Thomas et al. reported that gait disorder was prevalent in dementia patients and it was associated with greater ADL function limitation [92]. Guralnik et al. found that gait speed alone is nearly as good a predictor of disability outcome as the full performance battery [106].

5.3.3 Age was negatively, weakly but significantly associated with basic ADL (BI)

Population-based studies have demonstrated that age was associated with the functional status in the elderly; all patterns of physical functions tend to significantly decrease with age [55,103,105]. In the present study, BI decreased sharply with age (Table 9). This indicates that old age contributed to the basic ADL in patients with dementia. Pearson partial correlation analyses revealed that age was negatively, weakly but significantly correlated with BI after adjusted for gender, comorbidity, medication use, hospital stay duration and GDS ($r=-0.14$, $p=0.010$). Further multiple regression analyses showed that age alone can account for 14.0% of BI. This result was consistent with most previous population-based studies [55, 103]. Rapp et al. reported that the correlation coefficient of age and ADL was $r=-0.108$, $p=0.038$ (mean age 84.31±5.68), showed that advanced age was an independent risk factor for functional disability in community-dwelling and nursing home residents [35]. Present study indicated that age could speed up basic ADL disability in the geriatric hospitalized patients with dementia, and that age was negatively, weakly but significantly associated with functional status of patients with dementia. Controversial, Farias et al. reported that age was not significantly associated with performance in any of the functional domains in a memory clinics sample (mean age 71.67±8.52, mean MMSE 22.02±5.1) [65]. Mok et al. using a hospital sample of AD (mean age 80.18±8.1, mean MMSE 11.51±6.75), reported that age is not a significant factor contributing to the decline in functional abilities when compared with the stage of dementia [66]. These results indicated that the impact of age on the functional status in hospitalized patients with dementia is not the same as in population-based studies due to the fact that the functional status of hospitalized patients with dementia was severely impacted by acute medical conditions.

5.3.4 Comorbidity was weakly but significantly associated with basic ADL (BI)

It has been demonstrated that significant comorbidities could result in physical function limitations, which eventually reach a certain level and result in ADL disability

[42-44,129-130]. In the present study, descriptive statistical results showed that with increasing comorbidity, BI decreased (Table10). Correlation analyses revealed that comorbidity was negatively, weakly but significantly correlated with BI, even after adjusted for age, gender, hospital stay duration, medication use and GDS (r=-0.13, p=0.015). Multiple regression analyses showed that comorbidity alone could account for 21.0% of BI. While age is entered into the analysis model, the ß of comorbidity was -0.16 and the ß of age was -0.14. When cognitive measure and mobility measure are entered into the model, comorbidity was not significant. This result indicates that although basic ADL of patients with dementia in the present study could be affected by comorbidity, comorbidity was not a main determinant of basic ADL due to the fact that the majority of patients in the present study had advanced cognitive impairment, which suggested that for patients with advanced cognitive impairment in a geriatric hospital, cognitive function and mobility are more important determinants of the functional status as compared to comorbidity. Another possible reason might be that in the present study comorbidity was measured simply by using the total number of coexisting medical conditions without considering their severity and hence not allowing for possible attenuation of the impact of comorbidity on basic ADL. So the impact of comorbidity on the functional status of patients with dementia needs to be investigated by further studies using standard measurements of comorbidity. Consistent with previous studies [37, 42], present study showed that comorbidity as organic impairment could result in multiple physical function limitations and basic ADL disability, and that comorbidity was negatively, weakly but significantly associated with the basic ADL (BI) of patients with dementia in a geriatric hospital.

5.3.5 Cognitive function was significantly associated with mobility

It has been established through researches that diminished mobility is very common in patients with dementia [53,104]. Motor function could be affected in the elderly with very mild cognitive impairment [97]. Mobility as a functional outcome depends largely on intact cognitive function [89-92,112-114]. In the present study descriptive statistics showed that with the decline of MMSE score, TUG category increased, Tinetti-Balance, Tinetti-Gait, Tinetti-Total decreased, and with increasing Tinetti-Total, MMSE category decreased, indicating that mobility in the present sample was associated with cognitive function. Pearson correlation analyses, while adjustment for the potential confounders such as age,

gender, GDS, comorbidity, hospital stay duration, medication use, revealed a significant relationship between MMSE category and TUG category as well as Tinetti-Total. Further multiple regression analyses showed that MMSE category alone could account for 11.0% of TUG category, and 8.0% of Tinetti-Total. When age and comorbidity were entered into the regression analysis model to predict TUG category, the ß of MMSE category was 0.35 and the ß of comorbidity was 0.23, and to predict Tinetti-Total, the ß of MMSE category was -0.31 and the ß of comorbidity was -0.27 and the ß of age was not statistically significant. These results indicate that although mobility in geriatric hospitalized patients with dementia could be affected by both cognitive function and comorbidity, cognitive measure (MMSE category) accounted for TUG category and Tinetti-Total better than comorbidity did. Interestingly, age was not a significant independent predictor of mobility in these selected patients. Present result is supported by previous studies: Thomas et al. reported that the prevalence of gait impairment increases with dementia severity and the average score on the MMSE was 19.36±0.23 for those with gait disorder as compared to 20.05 ±0.31 for those without [92]. The review by Van Lersel et al. indicated that walking speed decreased in dementia compared to healthy controls and decreased further with a progressing severity of dementia [101]. The present study supported the disablement process model applied to dementia [26], cognitive impairments could result in function limitations, including diminished mobility, and mobility as a part of ADL was associated with cognitive function.

5.3.6 Comorbidity was weakly associated with mobility

Comorbidity as an organic impairment could result in physical function limitations such as diminished mobility. It is clear that mobility could be affected by a large number of comorbidities such as neuromuscular disorders, osteoarthrosis, peripheral vascular diseases, which could restrict mobility directly, and cardio-pulmonary diseases, sensorial organ disorders; mental disease and so on could affect mobility indirectly. In the present study descriptive statistics showed that with increasing comorbidity, mobility impairment according to TUG category as well as according to Tinetti-Gait, Tinetti-Balance and Tinetti-Total increased. Correlation analysis adjusted for age, gender, medication use, GDS and hospital stay duration revealed that comorbidity is significantly correlated with mobility. Multiple regression analyses revealed that comorbidity alone could account for 4.1% of TUG category and 5.7% of Tinetti-Total. This result is consistent with most

previous population-based studies [42,127], and provides further evidence that comorbidity is associated with mobility in hospitalized patients with dementia. Mobility in this selected sample was impacted by comorbidities. However, the weak correlation between comorbidity and mobility reflects the fact that although patients with dementia in a geriatric hospital suffered from multiple coexisting medical conditions, mobility was mainly affected by cognitive function rather than by comorbidity.

5.3.7 Age was not associated with mobility in the present study

Most previous population-based studies have demonstrated that age was negatively associated with mobility in the healthy elderly and there was a clear age-related deterioration in gait and balance in most of normal old population [105, 109, 123-126]. Rantanen et al. reported that with increasing age, the muscle strength may eventually decline to a level where the weakness starts to restrict the ability to carry out every day tasks [125]. Many observational studies confirmed that muscle weakness is a powerful risk factor for functional limitations, disability and mortality in old age [126]. And there are evidences that motor dysfunctions are very common in cognitively impaired elderly [104, 92-93]. However, in the present study, age was not associated with the mobility measures. Descriptive statistics showed that age was not significant in the TUG groups, no linear relationship between age and Tinetti-Total was found and across the age subgroups, all mobility measures showed a threshold between age subgroups 2 and 3. Before age subgroup 3, relatively younger patients showed a worse mobility. Correlation analyses including bivariate or partial analyses showed no significant correlations between age and mobility measurements. This result is in contrast with the majority of previous population-based studies on cognitive normal healthy elderly, in which it is consistently agreed that mobility is a particularly important functional ability that could be impaired with age, and age is negatively associated with all patterns of motor functions [88,102,109,135]. However, the present study focused on geriatric hospitalized patients with dementia. This was a highly selective group of old aged patients. The mobility of these patients was largely impacted by advanced cognitive impairment and acute medical conditions (as present results showed). In this selected sample, the impact of age on mobility cannot be expected to be the same as in population-based samples, since the majority of patients with dementia in the geriatric hospital had very advanced cognitive impairment and suffered from multiple coexisting medical conditions such that

age plays a less important role in these selected patients. Mobility in this group of patients was mainly affected by cognitive function and comorbidity rather than age. Additionally, in the present sample the percentage of VD was considerably higher, and Table 2 shows that VD patients were younger than the AD and DS subgroups with a higher percentage of coexisting strokes, which could impact the mobility of these patients and further attenuate the relationship between age and mobility. However, the present study focuses on the relationship between cognitive function and functional status, in most cases age was adjusted as a confounder. Although the present results showed that age was not associated with mobility in the geriatric hospitalized patients with dementia, further studies to investigate the exact relationship between age and mobility in the geriatric hospitalized patients with dementia are needed.

5.3.8 Age was weakly, negatively but significantly associated with cognitive function

It has been demonstrated that dementia is an age-related disease, cognitive decline is associated with age, even in the normal elderly, and old age is at a higher risk of developing cognitive decline [11, 22]. Most epidemiological studies on dementia showed that the incidence of dementia increases with age dramatically [12-13]. Descriptive statistical results in the present study showed that with increasing age MMSE category increased. Pearson partial correlation analysis revealed a weak but significant correlation between age and MMSE category (r=0.13). Multiple regression analysis showed that age alone accounts for 2.2% of MMSE category. This was consistent with most previous population-based studies; old age could be an independent risk factor of dementia [31, 35]. Present study further supported that age was negatively associated with cognitive function and dementia is an age-related disease.

5.3.9 Age was not associated with comorbidity in the present study

It has been demonstrated that comorbidity is very common in the elderly population and that comorbidity increases sharply with age [127,129,131]. The present study showed that the average comorbidity reached11.5±4.2, however, age was not correlated with comorbidity, which contradicts most previous population-based studies [130,145]. It is worth to note again that this is a selected sample deriving from a geriatric hospital and that all subjects suffered from multiple coexisting medical conditions and advanced dementia, which is not comparable to a cognitively normal or healthy elderly sample.

Based on this selected sample, although the statistics showed that age was not associated with comorbidity, one cannot draw a general conclusion regarding the relationship between age and comorbidity from these results. Further studies are needed to investigate the relationship between age and comorbidity in geriatric hospitalized patients with dementia.

5.3.10 Comorbidity was not associated with cognitive function in the present study

Although both comorbidity and dementia are age-related, it still remains unclear whether there is a relationship between comorbidity and cognitive function. Landi et al reported that patients with dementia have less comorbidity than those without dementia [128]. Blaum et al. found that more than one-third of people with lower cognitive performance had three or more coexisting diseases and conditions [42]. Doraiswamy et al found that there is a strong association between comorbidity and cognitive function in AD [127]. Jelicic et al. reported that cognitive function in patients living in the community is not consistently affected by specific diseases with the exception of stroke and asthma/bronchitis [132]. Maslow et al. pointed out that comorbidity could exacerbate cognitive and other symptoms in patients with dementia [130]. In the present study, descriptive statistics showed that MMSE category decreased with increasing comorbidity, which was consistent with Landi et al.'s result. But in the MMSE group, comorbidity was not statistically significant. Furthermore, Pearson correlation analyses revealed that comorbidity was not correlated with MMSE category, which indicates that there was no significant relationship between comorbidity and cognitive function in the present study. According to the disablement process model applied to dementia, comorbidity as an organic impairment, together with cognitive impairment could result in physical functional limitations and disability but may not be correlated with each other.

5.3.11 Summary of the relationship between cognitive function, mobility, age, comorbidity and basic ADL in the present study

The present study showed that cognitive impairment as a core component of dementia was significantly associated with basic ADL (BI). MMSE category alone could account for 45% of variance in BI. It could be an independent predictor of functional status of patients with dementia in a geriatric hospital. Mobility as a core component of basic ADL was associated with cognitive function too. MMSE category alone could account for 33.6% of

TUG category and 29.3% of Tinetti-Total variances. The functional status of patients with dementia in a geriatric hospital was mainly determined by cognitive function. Age and comorbidity were negatively, weakly but significantly associated with basic ADL (BI); both of them might speed up the process of basic ADL disability in hospitalized patients with dementia and could account for 12.3% and 14.8% of BI variance, respectively. Additionally, age was negatively associated with cognitive function and accelerated cognitive decline. And in this selected sample, mobility as a functional outcome was mainly affected by cognitive function, comorbidity only accounted for 20.7% of TUG category and 24.2% of Tinetti-Total, and age was not associated with mobility. This reflected the fact that in hospitalized patients with dementia, the functional status, including both basic ADL and mobility was mainly determined by cognitive function and impacted to some extent by comorbidity, since most patients with dementia in the geriatric hospital had advanced cognitive impairment and suffered from multiple comorbidities. Although correlation coefficients showed that the relationship between mobility and BI was stronger than the relationship between Barthel Index and cognitive function in the present study, mobility itself is a part of basic ADL and some basic ADL tasks overlap with mobility.

The present study further supported the disablement process model applied to dementia and the three possible scenarios for the role of cognitive function on the loss of ADL independence. The recent study also demonstrated that both of these theoretical concepts were applicable to patients with dementia in the geriatric hospital. Consistent with most of population-based studies, the present study showed that although the functional status of patients with dementia in the geriatric hospital could be impacted by multiple coexisting medical conditions and very old age, cognitive function is still the most important determinant of basic ADL, and mobility as a part of basic ADL largely depends on cognitive function too.

5.4 Geriatric Depression Scale was not suited for the present sample

Some researchers demonstrated that increasing dementia is associated with increasing depression and both conditions are associated with functional disability [142,146]. In the present study, Geriatric Depression Score (GDS) was not statistically significant in any analyses including descriptive statistics, correlation analyses and multiple regression analyses. This was in contradiction to most of previous studies. However, present sample

is a highly selected sample, the majority of patients in this sample were very old and their dementia too severe to be tested accurately by GDS due to poor cooperation. This situation could attenuate the relationship between cognitive function, depression and basic ADL in this sample. In the present study, out of a total number of 871 dementia cases, only 352 cases were successfully assessed by GDS. A large number of patients could not be assessed by GDS due to severe dementia, or critical or poor medical conditions. This result indicates that GDS assessment might be not suited for very old patients with severe dementia in the geriatric hospital. Further studies are needed to determine a suitable MMSE range for GDS assessment in geriatric hospital.

5.5 Summary of discussion

Present study concluded that the prevalence of dementia in the geriatric hospital was higher than in population-based studies. In addition, the percentage of vascular dementia in the present study was higher than in the majority of population-based studies. Patients with dementia in the geriatric hospital were fairly old, suffered from multiple medical conditions and showed advanced cognitive impairment and multiple marked physical functional deficits. The majority of patients with dementia in the geriatric hospital were dependent in basic ADL. The functional status of these selected patients was impacted by many factors, especially comorbidity and very old age, in most case they were inter-related and were frequently observed coincidentally such that they might speed up the progression of functional disability. However, cognitive function still is the most important determinant of the physical functional status of patients with dementia in the geriatric hospital. It could even be viewed as an independent predictor of the physical functional status. The mobility of these selected patients was impacted by comorbidity too, and most patients showed poor mobility. However, mobility as a core component of basic ADL largely depends on cognitive function rather than comorbidity. It is worth mentioning that age as an independent risk factor of cognitive decline could speed up the process of basic ADL disability, but age was not a significant factor impacting mobility and comorbidity in this selected sample of dementia cases. Consistent with most previous population-based studies, the present study suggests that cognitive function is the most important determinant of the functional status of patients with dementia in a geriatric hospital. Management of patients with dementia requires paying attention to their acute

medical conditions as well as to the rehabilitation of their cognitive and physical impairments.

5.6 Limitations of the present study

There are some limitations of the present study that need to be addressed. First, this is a retrospective study based on a through review of medical records in a geriatric hospital. Thus, potential bias caused by missing data is inevitable. In the present study, due to critical or poor medical conditions, a large number of cases lack MMSE and TUG, this could have attenuated the relationship between the investigated variances. Additionally, the prevalence of dementia in the present study was underestimated due to 290 medical records are not available at the study moment. Second, the MMSE score in the present study was not adjusted by level of education. This could have influenced the judgement of dementia severity, although the majority of patients in this sample had advanced dementia. Third, in the present study, the dementia syndrome subgroup comprised all other types of dementia including some advanced stage dementia and dementia of unknown origin, which resulted in a higher prevalence of DS subgroup. Although this is a real situation in a geriatric hospital, this result was not ideal for research purpose. Fourth, comorbidity in the present study was measured as a total number of coexisting medical conditions. Although in fact the most significant medical conditions were accounted for, the severity of coexisting diseases was not considered. This could have influenced the prediction of the impact of comorbidities on functional status. And lastly, as mentioned before, this is a highly selected sample. Most patients in this sample were transferred from another specialized hospital because they needed further medical interventions as well as early rehabilitation of physical functions. The patients tended to be older and to show multiple functional deficits. Most of them had acute medical conditions. So the results of the present study cannot be generalized for the general population but may well be generalizable to the ever increasing sub-population of dementia patients in geriatric hospitals. Of course, more studies are needed that are explicitly focusing on this special group of severely impaired old-aged patients to fully understand their disablement process such that more specifically suited stratagem of interventions can be developed to fit their complex needs.