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Primary age-related tauopathy in a Chinese cohort*#

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Primary age-related tauopathy (PART) is characterized by the presence of tau neurofibrillary tangles (NFTs) which are typically observed in Alzheimer's disease (AD) brains, with few or without β-amyloid (Aβ) plaques. The diagnosis of PART can be categorized into "definite" or "possible" depending on the amount of Aβ plaques. Definite PART is diagnosed when NFTs are observed and the Braak stage is ≤IV, with Thal Aβ Phase 0 (Crary et al., 2014). According to the neuropathological diagnostic criteria, we reported that PART was frequently observed in the Chinese population according to our findings from specimens in our brain bank, with 47% of brain bank subjects meeting the criteria for PART. There is no consensus on the nature of PART. It remains to be elucidated whether PART is an early form of AD or a novel tauopathy (Duyckaerts et al., 2015; Jellinger et al., 2015).

Pathological expression of four proteins, including hyperphosphorylated-τ (HPτ), Aβ, transactive response DNA-binding protein 43 (TDP43), and α-synuclein (αS), is commonly observed in aging brains (Elobeid et al., 2016). Although these pathological proteins are assumed to be characteristic for neurodegenerative disorders, they are not restricted to these diseases. A previous postmortem study has shown that these proteins are also present in aged non-demented brains (Elobeid et al., 2016). For example, "occult or incidental" αS expression is observed in 5% to 31% of aged subjects (Mikolaenko et al., 2005; Alafuzoff et al., 2009) and pathological expression of TDP43 in 3% to 40% of aged subjects (Uchino et al., 2015). Few studies have investigated the distribution of p62 in aged subjects without cognitive impairment or PART subjects (Kuusisto et al., 2002). Therefore, the present study aimed to assess the clinicopathological characteristics of Chinese PART brains in our brain bank and the distribution patterns of the abovementioned pathological proteins (HPτ, TDP43, p62, Aβ, and αS) in PART brains of our brain bank.

The demographic information of all subjects is summarized in Table 1. In the present study, 64 (65%) and 34 (35%) subjects were male and female, respectively. The age at death of all subjects was ≥50 years. There were 46 (47%) PART cases, 23 AD (24%) cases, 4 (4%) cerebrovascular cases, and 12 (12%) cases of other disorders. Only 13 subjects (13%) were neurologically unimpaired. The proportion of AD cases increased with age (60–69 years, 5%;

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70–79 years, 22%; 80–89 years, 38%; ≥90 years, 53%), while PART did not show this trend (Cochran-Armitage test; the *P* values for PART and AD were 0.096 and <0.01, respectively). It can be observed that PART was common in Chinese subjects. Among subjects with PART, only 2 (4%) showed mild cognitive impairment (MCI), while the others did not show evident cognitive impairment. In all the subjects, 41% had cancer, 13% had other brain disorders including brain hemorrhage, 11% had pulmonary disorders, 9% had cardiac diseases, and 11% (5 subjects) had psychiatric diseases, including schizophrenia (3 subjects) and depression (2 subjects). In general, the subjects with PART did not show apparent dementia symptoms (Table 2).

The mean age at death of PART subjects was (76±12) years (70% male, 30% female), whereas the mean age at death of AD subjects was (84±9) years. The majority of these PART subjects were aged less than 90 years at death. Braak NFT staging of all PART and AD cases is shown in Table 3. The HPτ-immunoreactivity (IR) stage of PART cases ranged from I to IV, with 61% of subjects at Braak stages I–II, 22% at Braak stage III, and 17% at Braak stage IV. Braak NFT staging increased with age in PART. All subjects in the 50–59-year group were at Braak stage I, 80% of the 60–69-year group at Braak stage I and 10% at Braak stage II, and 28% of the ≥90-year group at Braak stage IV. All AD subjects were at Braak NFT stage III or above and older than 60 years. All subjects in the 60–69-year group were at Braak NFT stage III, all in the 70–79-year group at Braak NFT stages III–IV, and 44% in the 80–89-year group at Braak stages V–VI.

PART brains showed decreased weight with age (Table 4; the *P* value for the brain weight column trend is 0.276 as calculated by Pearson test). All brains were tau-positive, and 2 out of 46 PART brains showed Thal stage 1 Aβ plaques, suggesting that they were possible PART. HPτ-IR was observed in the hippocampus of 89% of PART subjects, in the temporal cortex of 41% of subjects, and in the parietal inferior lobule of 7% of subjects. TDP43-IR was observed in 67% of PART subjects, among whom 46% subjects showed TDP43-IR in the amygdala and 61% in the hippocampus. p62-IR was observed in 70% of PART subjects, among whom 37% showed p62-IR in the temporal cortex and 63% in the hippocampus. No expression of TDP43 or p62 was observed in the 50–59-year group, but the expression of these two proteins increased significantly in subjects over 60 years old. αS was observed in 4% of PART subjects with only the substantia nigra and medulla oblongata showing positive expression and not the amygdala.

Table 1 Demographics of the included subjects

Age group (year)	*n*	Gender		No neuropathological lesions present	Cerebrovascular lesion	PART	AD	Other brain disorders
		M	F					
50–59	18	11 (61)	7 (39)	9 (50)	2 (11)	3 (17)	0 (0)	4 (22)
60–69	18	14 (78)	4 (22)	3 (17)	1 (5)	10 (56)	1 (5)	3 (17)
70–79	23	15 (65)	8 (35)	0 (0)	1 (4)	13 (57)	5 (22)	4 (17)
80–89	24	14 (58)	10 (42)	1 (4)	0 (0)	13 (54)	9 (38)	1 (4)
≥90	15	10 (67)	5 (33)	0 (0)	0 (0)	7 (47)	8 (53)	0 (0)
Total	98	64 (65)	34 (35)	13 (13)	4 (4)	46 (47)	23 (24)	12 (12)

Data are expressed as number (percentage) or number. F, female; M, male; PART, primary age-related tauopathy; AD, Alzheimer's disease

Table 2 Clinical symptoms in the PART cases

Braak NFT stage	*n*	MCI	Cardiac	Pulmonary	Brain	Psychiatric	Cancer	Others
I	20	0 (0)	3 (15)	1 (5)	0 (0)	1 (5)	12 (60)	3 (15)
II	8	0 (0)	0 (0)	1 (13)	0 (0)	1 (13)	4 (50)	2 (25)
III	10	1 (10)	0 (0)	1 (10)	4 (40)	1 (10)	3 (30)	0 (0)
IV	8	1 (13)	1 (13)	2 (25)	2 (25)	2 (25)	0 (0)	0 (0)
Total	46	2 (4)	4 (9)	5 (11)	6 (13)	5 (11)	19 (41)	5 (11)

Data are expressed as number (percentage) or number. PART, primary age-related tauopathy; NFT, neurofibrillary tangle; MCI, mild cognitive impairment

AD brains also showed decreased weight with age (Table 5). TDP43 was observed in 83% of AD subjects, among whom 61% showed TDP43-IR in the amygdala and 70% in the hippocampus. p62-IR was observed in 83% of AD subjects, among whom 78% showed p62-IR in the temporal cortex and 78% in the hippocampal formation. TDP43 and p62 were negative in the 50–59-year group of AD subjects. αS-IR was negative in all AD brains.

The concurrent expression of pathological proteins is listed in Table 6. It was found that the concurrent expression of TDP43 and p62 increased with the Braak NFT stage. Twenty-five (55%) PART subjects showed concomitant HPτ/TDP43/p62, 6 (13%) PART subjects showed $TDP43^{+}/p62^{-}$, and 7 (15%) PART subjects showed $TDP43^{-}/p62^{+}$. The expression of TDP43 (83%), p62 (83%), and $HP\tau/TDP43^{+}/p62^{+}$ (79%) in AD subjects was significantly higher than that in PART subjects.

PART was proposed to include a pathological continuum from focal NFTs in normal aged brains to dementing ones with NFTs but without amyloid plaques (Crary et al., 2014). Overall, the clinical symptoms of PART reported in the literature are mild (Besser et al., 2017; Bell et al., 2019). We postulate that PART is different from tangle-predominant

Table 3 Distribution of hyperphosphorylated tau pathology in PART and AD

Age group (year)	PART						AD					
	n	M/F	Braak NFT stage				*n*	M/F	Braak NFT stage			
			I	II	III	IV			III	IV	V	VI
50–59	3	2/1	3 (100)	0 (0)	0 (0)	0 (0)						
60–69	10	8/2	8 (80)	1 (10)	0 (0)	1 (10)	1	0/1	1 (100)	0 (0)	0 (0)	0 (0)
70–79	13	9/4	4 (31)	3 (23)	3 (23)	3 (23)	5	3/2	1 (20)	3 (60)	0 (0)	1 (20)
80–89	13	7/6	3 (23)	2 (16)	6 (46)	2 (16)	9	6/3	1 (11)	4 (45)	2 (22)	2 (22)
≥90	7	6/1	2 (28)	2 (28)	1 (16)	2 (28)	8	4/4	4 (50)	2 (25)	1 (13)	1 (13)
Total	46	32/14	20 (43)	8 (17)	10 (22)	8 (18)	23	13/10	7 (30)	9 (39)	3 (13)	4 (18)

Data are expressed as number (percentage) or number. PART, primary age-related tauopathy; AD, Alzheimer's disease; M, male; F, female; NFT, neurofibrillary tangle

Table 4 Altered protein distribution in the neuroanatomical predilection areas in PART

Age group (year)	*n*	BW (g)	HPτ						Aβ			
			Tem	Hip.A	Hip.M	Hip.P	LPI	Sum	Men	Par	Occ	Sum
50–59	3	1240±295	2 (67)	1 (33)	2 (67)	1 (33)	0 (0)	3 (100)	0 (0)	0 (0)	0 (0)	0 (0)
60–69	10	1290±120	4 (40)	5 (50)	9 (90)	5 (50)	1 (10)	10 (100)	0 (0)	0 (0)	0 (0)	0 (0)
70–79	13	1176±79	7 (54)	10 (77)	12 (92)	6 (46)	1 (8)	13 (100)	0 (0)	1 (8)	0 (0)	1 (8)
80–89	13	1158±130	4 (31)	9 (69)	12 (92)	6 (46)	1 (8)	13 (100)	0 (0)	0 (0)	0 (0)	0 (0)
≥90	7	1133±81	2 (29)	7 (100)	6 (86)	3 (43)	0 (0)	7 (100)	1 (14)	1 (14)	1 (14)	1 (14)
Total	46	1184±138	19 (41)	32 (70)	41 (89)	21 (46)	3 (7)	46 (100)	1 (2)	2 (4)	1 (2)	2 (4)

Age group (year)	αS*				TDP43			p62		
	AE	SN	MO	Sum	AE	Hip.M	Sum	Tem	Hip.M	Sum
50–59	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
60–69	0 (0)	0 (0)	0 (0)	0 (0)	2 (20)	5 (50)	6 (60)	3 (30)	4 (40)	5 (50)
70–79	0 (0)	0 (0)	0 (0)	0 (0)	3 (23)	7 (54)	7 (54)	5 (38)	9 (69)	10 (77)
80–89	0 (0)	1 (8)	2 (15)	2 (15)	10 (76)	10 (76)	12 (92)	6 (46)	9 (69)	10 (76)
≥90	0 (0)	0 (0)	0 (0)	0 (0)	6 (86)	6 (86)	6 (86)	3 (71)	7 (100)	7 (100)
Total	0 (0)	1 (2)	2 (4)	2 (4)	21 (46)	28 (61)	31 (67)	17 (37)	29 (63)	32 (70)

Data are presented as mean±standard error (SE), number (percentage), or number. * αS-positive except Parkinson's disease cases. PART, primary age-related tauopathy; BW, brain weight; HPτ, hyperphosphorylated-τ; Aβ, β-amyloid; αS, α-synuclein; TDP43, transactive response DNA-binding protein 43; Tem, temporal pole; Hip.A, hippocampus anterior; Hip.M, hippocampus middle; Hip.P, hippocampus posterior; LPI, lobulus parietalis superior; Men, meninges; Par, parietal; Occ, occipital pole; AE, amygdala/entorhinal cortex; SN, substantia nigra; MO, medulla oblongata

Table 5 Altered protein distribution in the neuroanatomical predilection areas in AD

Age at death (year)	*n*	BW (g)	HPτ						Aβ			
			Tem	Hip.A	Hip.M	Hip.P	LPI	Sum	Men	Par	Occ	Sum
60–69	1	1220	1 (100)	1 (100)	1 (100)	0 (0)	0 (0)	1 (100)	0 (0)	1 (100)	1 (100)	1 (100)
70–79	5	1168±97	5 (100)	5 (100)	5 (100)	1 (20)	3 (60)	5 (100)	2 (40)	5 (100)	5 (100)	5 (100)
80–89	9	1131±172	6 (67)	8 (89)	8 (89)	3 (33)	4 (44)	9 (100)	4 (44)	8 (89)	8 (89)	9 (100)
≥90	8	1129±95	7 (88)	7 (88)	8 (100)	4 (50)	2 (25)	8 (100)	5 (63)	7 (88)	5 (63)	8 (100)
Total	23	1154±133	19 (83)	21 (91)	22 (96)	8 (35)	9 (39)	23 (100)	11 (48)	21 (91)	19 (83)	23 (100)

Age at death (year)	αS*				TDP43			p62		
	AE	SN	MO	Sum	AE	Hip.M	Sum	Tem	Hip.M	Sum
60–69	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
70–79	0 (0)	0 (0)	0 (0)	0 (0)	5 (100)	3 (60)	5 (100)	5 (100)	5 (100)	5 (100)
80–89	0 (0)	0 (0)	0 (0)	0 (0)	4 (44)	7 (78)	8 (89)	7 (78)	8 (89)	8 (89)
≥90	0 (0)	0 (0)	0 (0)	0 (0)	5 (63)	6 (75)	6 (75)	6 (75)	5 (63)	6 (75)
Total	0 (0)	0 (0)	0 (0)	0 (0)	14 (61)	16 (70)	19 (83)	18 (78)	18 (78)	19 (83)

Data are presented as mean±standard error (SE), number (percentage), or number. * αS-positive except Parkinson's disease cases. AD, Alzheimer's disease; BW, brain weight; HPτ, hyperphosphorylated-τ; Aβ, β-amyloid; αS, α-synuclein; TDP43, transactive response DNA-binding protein 43; Tem, temporal pole; Hip.A, hippocampus anterior; Hip.M, hippocampus middle; Hip.P, hippocampus posterior; LPI, lobulus parietalis superior; Men, meninges; Par, parietal; Occ, occipital pole; AE, amygdala/entorhinal cortex; SN, substantia nigra; MO, medulla oblongata

Table 6 Concomitant expression of altered proteins in PART

Group	*n*	Gender (M/F)	Age (year)	$αS^{+*}$	$TDP43^{+}$	$p62^{+}$	$TDP43^{+}/p62^{+}$	$TDP43^{+}/p62^{-}$	$TDP43^{-}/p62^{+}$	$TDP43^{-}/p62^{-}$
PART										
I	20	14/6	70±12	0 (0)	11 (55)	11 (55)	7 (35)	4 (20)	4 (20)	5 (25)
II	8	7/1	82±11	0 (0)	5 (63)	6 (75)	5 (63)	0 (0)	1 (13)	2 (25)
III	10	4/6	82±7	1 (10)	8 (80)	7 (70)	6 (60)	2 (20)	1 (10)	1 (10)
IV	8	7/1	81±11	1 (12)	7 (88)	8 (100)	7 (88)	0 (0)	1 (12)	0 (0)
All	46	32/14	76±12	2 (4)	31 (67)	32 (70)	25 (55)	6 (13)	7 (15)	8 (17)
AD	23	13/10	84±9	0 (0)	19 (83)	19 (83)	18 (79)	1 (4)	1 (4)	3 (13)

Data are presented as mean±standard error (SE), number (percentage), or number. * αS-positive except Parkinson's disease cases. PART, primary age-related taupathy; M, male; F, female; αS, α-synuclein; TDP43, transactive response DNA-binding protein 43; AD, Alzheimer's disease

senile dementia because only a minority of PART in our study was diagnosed with MCI. Similarity between other tauopathies and neuropathy characterized by NFTs such as progressive supranuclear palsy, corticobasal degeneration, and even frontotemporal lobar degeneration was not observed. Among the subjects who were older than 50 years and donated their brains for autopsy, 47% met the pathological criteria for PART. In Korea, PART was frequently observed in elderly subjects at autopsy (Kim et al., 2019). According to the Forum on the Development Trend and Countermeasures of China's Socialized Old-Age Care held in Kunming in September 2005, the number of elderly people over 60 years old in China has reached 130 million, more than 10% of the total population, and it has been increasing at an average annual rate of 3%. Based on the result of the fifth census, the number of people over 60 years old had exceeded 200 million by 2015, accounting for 14% of the total population; by 2025, this number will reach 280 million, accounting for 18.4% of the total population. Therefore, it is postulated that there will be a large number of PART patients in China based on our observation, increasing the awareness of the Chinese government in preventing dementia from the early stage of its continuum (Kim et al., 2019).

Tauopathy is commonly observed in the brains of aging individuals (Braak et al., 2011). In the present

study, tauopathy in PART was restricted to the hippocampus and the temporal pole with 82% of subjects at Braak stages I–III and 18% at Braak stage IV. The majority of the PART subjects were cognitively unimpaired with only 4% having MCI. Interestingly, 41% of the subjects had malignant diseases and 11% had psychiatric diseases, including schizophrenia and depression. The association between PART and malignant tumors and psychiatric diseases requires further study.

In general, PART subjects were significantly younger than AD subjects. There were seven PART subjects older than 90 years without cognitive impairment. A study has shown that NFTs are observed in the brain years before amyloid plaques in normal aging brains (Tsartsalis et al., 2018). Whether young subjects with PART will progress to AD needs to be further investigated.

In the present study, pathological proteins including HPτ, TDP43, and p62 were frequently observed in PART brains. Expression of TDP43 was most commonly observed in the hippocampus and amygdala (Nelson et al., 2019). It was reported that PART brain atrophy was associated with TDP43 expression (Josephs et al., 2019). In the present study, expression of TDP43 was found in 67% of PART subjects, which was higher than that reported in two previous studies (Uchino et al., 2015; Elobeid et al., 2016). We are the first to report that the expression of TDP43 was primarily observed in the amygdala and subsequently the hippocampus (Zhang et al., 2019). There is no previous report about p62 distribution in PART. In the present study, we found that p62 is commonly expressed in the hippocampus and the temporal pole in PART.

Similar to NFTs observed in normal aging brains, the expression of αS is present in 19% of normal aging subjects (Elobeid et al., 2016). In our subjects with αS-IR, 4% had PART, which is lower than that of the previous report. The altered proteins, including p62 and TDP43, are frequently observed in AD brains. TDP43 proteinopathy was observed in 83% of AD subjects in our cohort in contrast to 36% and 57% of subjects with AD pathology in the previous studies (Arnold et al., 2013). A total of 83% of AD brains in our brain bank also showed concurrent HPτ and p62. In normal aging brains, 55% of them showed positive expression of three pathological proteins (Tau, TDP43, and p62) as observed in the present study. Therefore, multiple biomarkers should be examined in the susceptible regions of aged subjects (Elobeid et al., 2016; Josephs et al., 2016).

In conclusion, we compared the neuropathological characteristics of 46 PART and 23 AD brains out of the 98 subjects older than 50 years. We demonstrated that PART was common in our Chinese cohort and displayed abnormal protein aggregates. The majority of PART brains were at Braak stages I–III with little Aβ being present. In as many as 55% of the subjects, the expression of three pathological proteins in the same brain was noted, which suggests the potential interaction of these proteins and hence requires future investigation. Apart from the younger age at death, the incidence of concurrent expression of TDP43-IR or p62 in PART was different from that of AD brains. Therefore, it is likely that PART is a novel disease pathology distinct from AD (Nelson et al., 2016; Bell et al., 2019). Concurrent neurodegenerative pathology is frequent in the PART brain (Kovacs et al., 2013), and further studies assessing its underlying mechanism are required (Besser et al., 2019).

Materials and methods

Ninety-eight brains in the Chinese Brain Bank of Zhejiang University School of Medicine (Hangzhou, China) were assessed. All of the subjects met our inclusion criteria for brain banking: age at death ≥50 years, and the delay for postmortem processing less than 24 h. Out of 98 subjects, 44 PART subjects were confirmed based on the criteria which include an NFT Braak stage of ≤IV and Thal Aβ Phase of 0. Two subjects were classified as possible PART with NFT Braak stage ≤IV and Thal Aβ Phase 1.

Immunohistochemistry was completed on formalin-fixed brain tissues from all autopsy cases as previously described (Zhang et al., 2019). Briefly, donated brains were cut into slabs at autopsy based on our protocol and fixed in 10% buffered formalin in 0.1 mol/L phosphate-buffered saline (pH 7.4). Small blocks of brain tissue were collected from targeted regions and fixed for 2 d in formalin, followed by dehydration and embedding in paraffin. Brain tissue was then cut into 6-μm thick sections on a microtome. Free-floating brain sections were processed with 3%

H_2O_2 for 15 min to quench the endogenous peroxidase before antigen retrieval using a microwave for 15 min in the citrate buffer (pH 6.0). Sections were treated with 10% normal goat serum to block the non-specific binding sites before incubating with the primary antibody for overnight at 4 °C. After washing, sections were sequentially incubated with the appropriate secondary antibody and the avidin-biotinylated horseradish peroxidase (HRP) complex (ABC) system (Vector Laboratories, CA, USA). The activity of HRP was tested using a solution with 0.4 mg/mL 3,3'-diaminobenzidine (DAB) and 0.0006% hydrogen peroxide in Tris-buffered saline (TBS). The negative control sections were incubated with the secondary antibody and the avidin-biotinylated HRP complex only. The sections were aligned on gelatin-coated slides and dried before going through the dehydration and clearing steps. Finally, sections were coverslipped with a mounting medium.

After collecting the brains from their donors, the brains were weighed and fixed with 10% buffered formalin for 2–4 weeks. Brain samples were collected from 22 brain regions according to the standardized protocol. They were then cut into 6-μm thick sections as described above. Gross lesions and vascular abnormalities were assessed before and after staining with hematoxylin and eosin (H&E) as well as different immunohistochemistry (IHC) and special stains such as M-Ag (silver staining) and Gallyas. The 22 brain regions and their stains were summarized in Table S1.

Data analysis was performed using the IBM SPSS statistics software (Armonk, NY, USA). For continuous variables, they were expressed as mean± standard error (SE). Statistical difference between groups was assessed using either the Cochran-Armitage test or the Fisher's exact test. Correlation analysis between variables was assessed using the Pearson's correlation test.

Contributors

Xin WANG, Lei ZHANG, Juan-li WU, and Hui LU prepared the tissue for immunohistochemistry and performed statistical analysis. Ke-qing ZHU, Xin WANG, and Lei ZHANG contributed in the statistical assessment and data processing. Ke-qing ZHU designed the study, analyzed the results, and wrote the first version of the manuscript that was circulated among all the contributors for comments and suggestions. Hua-zheng LIANG, Chong LIU, Qing-qing TAO, and Zhi-ying WU contributed in the final version of the manuscript. All authors have read and approved the final manuscript. All authors have full access to all the data in the study and have responsibility for the integrity and security of the data.

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Compliance with ethics guidelines

Xin WANG, Lei ZHANG, Hui LU, Juan-li WU, Hua-zheng LIANG, Chong LIU, Qing-qing TAO, Zhi-ying WU, and Ke-qing ZHU declare that they have no conflict of interest.

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008 (5). Informed consent was obtained from all patients for being included in the study.

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List of electronic supplementary materials

Table S1 Assessment of the altered protein expression

中文概要

题　目：原发性衰老相关性 tau 病在中国人群中的临床病理学研究

目　的：分析中国人群中原发性衰老相关性 tau 病（PART）的临床病理学特点，并比较其与老年性痴呆之间的差异。

创新点：PART 为新近提出的概念，其与老年性痴呆的关系尚存在争论。目前未见针对中国人群 PART 的相关报道。本文首次报道了浙江大学医学院中国人脑库中的 PART 的临床病理学特点。

方　法：回顾性分析相关病例，严格纳入标准。PART 在中国人群中常见，50 岁以上人群占 47%。平均年龄（76±12）岁，女性 14 例（30%），男性 32 例（70%）。免疫组织化学法显示，按磷酸化 tau 的 Braak 分期，PART 大多为 I 到 III 期。异常蛋白 TDP43 和 p62 在 PART 中高表达，分别为 67% 和 70%；在老年性痴呆中分别为 83%和 83%。TDP43 和 p62 共表达在 PART 为 55%，在老年性痴呆为 79%。其中海马为 PART 常见累及部位，TDP43 为 61%，p62 为 63%。仅 4%的 PART 患者表现为轻度认知障碍。

结　论：PART 在中国人群中常见；PART 大多无明显痴呆症状；异常蛋白 TDP43 和 p62 在 PART 中高表达，与老年性痴呆相比存在差异。

关键词：原发性衰老相关性 tau 病（PART）；老年性痴呆；Tau 蛋白；TDP43；p62