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Cognitive Functions after Transradial Catheterization

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Abstract

Trans-Radial Catheterization (TRC) has becoming the most popular coronary intervention and proved as safe and efficient procedure. As previous studies reported risk of CVA after TRC, we want to assess the cognitive function in TRC patients. The cognitive function was assessed by Addenbrooke's cognitive examination and Mini mental state examination. The ACE questionnaire consists of five cognitive domain scores such as attention and orientation (18 points), memory (26 points), fluency (14 points), language (26 points), and Visio-spatial (16 points). . In our study, the scores of Attention and orientation are more in before procedure (15.3±2.93) compared to after procedure (14.52±3.03) (p=0.006). The scores of memory are more in after procedure (22.28±3.42) compared to before procedure (17.85±5.27) (p=0.000). The scores of fluency are more in before procedure (6.96±2.83) than after procedure (6.01±3.74) (p=0.003). The scores of language are little more in after (24.65±2.28) compared to before (24.3±2.51) (p=0.134) procedure. The scores of visuospatial are more in before (12.7±2.45) compared to after procedure (9.79±3.22) (p=0.000). The overall ACE scores are more in after procedure (76.7±10.5) compared to before procedure (75.6±11.8) (p=0.326). The MMSE scores are more in after (28.11±1.37) compared to before TRC procedure (26.15±1.91) (p=0.000). The cognitive function abnormality was there before the TRC (may be anxiety related), but improved after TRC.

Introduction

All over the world radial artery approach for coronary procedures is increasing as trans-radial catheterization (TRC) has better patient outcomes include shorter hospital stay, cost effectiveness, reduced access site complications [1] and the haemorrhagic complications are tenfold decreased in TRC compared to trans-femoral catheterization [2]. Previously, Lund et al. [3] was raised the concern regarding the TRC induces subclinical cerebral micro-emboli. It may cause cognitive impairment or other cerebral effects [3]. In this trans-radial era, we want to assess the cognitive functions in TRC patients.

Methods and Materials

It is a prospective study conducted in the department of Cardiology over 6 months with help of neuro-physician and psychiatrist. The patients who are undergoing TRC (either coronary angiogram - CAG or percutaneous intervention - PCI) are included in this study. Excluded those patients who had cerebro-vascular event, already known dementia or psychiatric illness, not able to understand or perform the questionnaire. Baseline clinical, demographic and interventional details are collected from patient case sheets. The assessment of cognitive function in study patients was done by Addenbrooke's Cognitive Examination (ACE) questionnaire. It consists of five cognitive domain scores such as attention and orientation (18 points), memory (26 points), fluency (14 points), language (26 points), and Visio-spatial (16 points). These domain scores also comprises into sub scores which are totally additive to 100 points. The higher scores denotes the better cognitive function. The normal range is 83 to 88 points. The MMSE (Mini mental state examination) are used to assess the severity and progression of cognitive impairment. It has 30 points. In our study, the ACE scores and MMSE scores are calculated prior and after TRC.

Results

217 patients with coronary artery disease were selected for PCI through radial route are included. Age ranged from 23 to 81 years (mean- 52.7±10.37yrs). Of these 158(72.8%) were males and 59(27.2%) were females. The risk factors observed in these patients were hypertension (58.5%), diabetes (36%), and smoking (25.3%). Most of them LV function was good (67.7%).In 95 patients only CAG and in 122 patients PCI was done. PCI was done in 55 patients with single vessel disease and 67 patients with multi vessel disease (Table 1).

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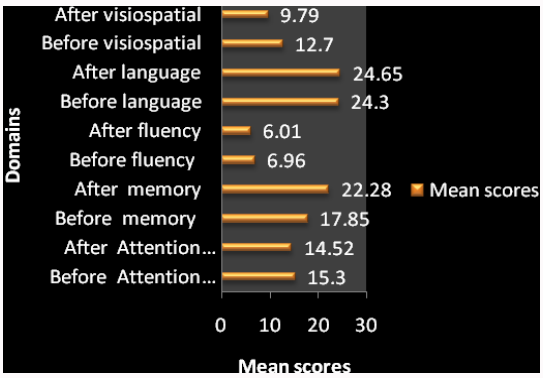

Figure 1: Domain scores between the before and after TRC.

Table 1: Patient Characteristics.

Characteristics (n=217)	Results
1. Sex	
Males	158 (72.8%)
Females	59 (27.2%)
2. Age (yrs)	
Range	23 - 81
Mean	52.7 ± 10.37
3. Risk factors	
Hypertension	127 (58.5%)
Diabetes	78 (36%)
Smoker	55 (25.3%)
4. LV function	
Good	147 (67.7%)
Mild	31 (14.3%)
Moderate	25 (11.55%)
Severe	14 (6.45%)
5. Severity of CAD	
SVD	55
MVD	67

Table 2: Domain scores between before and after TRC attention and orientation.

Domains	Mean	St Dev	P-value
Before TRC Attention and Orientation	15.3	2.93	0.006
After TRC Attention and Orientation	14.52	3.03	

The overall ACE scores are more in after procedure (76.7±10.5) compared to before procedure (75.6±11.8). The MMSE scores are more in after (28.11±1.37) compared to before TRC (26.15±1.91). There is no mortality or CVA or puncture site complications observed in these patients (Table 2).

Before versus after trc attention and orientation

The scores of Attention and orientation are more in before procedure (15.3±2.93) compared to after procedure (14.52±3.03). The attention and orientation of patient is decreased significantly after procedure (p=0.006). Especially in sub-scores, in which the tests are designed to detect higher attention by increasing complexity of the questions, the attention and orientation is decreased gradually as the severity of questionnaire is increased (Table 3).

Figure 2: Total ACE and MMSE scores between the before and after TRC.

Table 3: Sub scores of before and after TRC attention and orientation.

Sub scores	TRC procedure	Mean	St Dev	P-value
Orientation I	Before	4.31	1.33	0.219
	After	4.47	1.32	
Orientation II	Before	4.09	1.57	0.581
	After	4.16	1.19	
Registration	Before	2.912	0.283	0.867
	After	2.908	0.29	
Attention and concentration	Before	3.91	1.17	0
	After	3.35	1.41	

Table 4: Domain scores between before and after TRC memory.

Domains	Mean	St Dev	P-value
Before TRC memory	17.85	5.27	0
After TRC memory	22.28	3.42	

Table 5: Subscores of before and after TRC memory.

Sub scores	TRC procedure	Mean	St Dev	P-value
Recall I	Before	1.986	0.979	0.574
	After	1.935	0.895	
Antegrade memory	Before	5.41	1.08	0
	After	6.816	0.944	
Retrograde memory	Before	3.581	0.95	0
	After	3.926	0.378	
Recall II	Before	2.79	2.35	0
	After	4.79	1.46	
Recognition	Before	3.98	1.25	0
	After	4.816	0.944	

Before versus after trc memory

The scores of memory are more in after procedure (22.28±3.42) compared to before procedure (17.85±5.27) (Table 4). The sub-scores such as antegrade memory, retrograde memory, recall and recognition are also significantly increased after TRC (Table 5).

Comparison of before and after trc fluency

The scores of fluency are more in before procedure (6.96±2.83) than after procedure (6.01±3.74). The fluency is decreased after procedure, which is statistically significant (p=0.003) (Table 6).

Comparison of before and after trc language

The scores of language are little more in after (24.65±2.28)

Table 6: Domain scores between before and after TRC fluency.

Domains	Mean	St Dev	P-value
Before TRC fluency	6.96	2.83	0.003
After TRC fluency	6.01	3.74	

Table 7: Sub scores of before and after TRC fluency.

Sub scores	TRC procedure	Mean	St Dev	P-value
Letters	Before	3.36	1.54	0.002
	After	2.82	2.06	
Animals	Before	3.59	1.67	0.017
	After	3.19	1.82	

Table 8: Domain scores between before and after TRC language.

Domains	Mean	St Dev	P-value
Before TRC language	24.3	2.51	0.134
After TRC language	24.65	2.28	

compared to before (24.3±2.51) procedure but not statistically significant (Table 7).

Comparison of before and after trc visuo-spatial

The scores of visuo-spatial are more in before (12.7±2.45) compared to after procedure (9.79±3.22) (Table 8). The sub-scores such as wire cube, clock, counting dots, identifying letters are more in before procedure except overlapping pentagons (Table 9). These activities include copy the diagram (wire cube), draw a clock with specified time (clock), counting the number of dots and identifying the blurred letters (Table 10).

Before and after trc ace score

The overall ACE scores were more in after procedure (76.7±10.5) compared to before procedure (75.6±11.8) but not statistically significant (Table 11).

Before and after trc mmse

The MMSE scores are more in after transradial procedure (28.11±1.37) compared to before (26.15±1.91), which was statistically significant (p=0.000) (Table 12).

Discussion

Radial route is an alternative popular route for coronary procedures in present situation. It has many advantages compared to trans-femoral approach .According to European Society of Cardiology (ESC) 2015 guidelines recommended that the TRA is the preferred method of access (Class I indication) [4]. The AHA/ ACC supports the TRA which improves the quality of life, reduce cost burden and also improve ACS related outcomes [5]. It is safe and effective even in greater than 85 years, obese, females, high risk of bleeding complications [6].

A randomised study conducted by Kiemeneij et al. [7] compares the complications of radial, femoral and brachial approaches. They concluded that the complications are lower in radial access [7]. In a prospective study conducted by Mann et al. concluded that the significant reduction of vascular complications, shorter hospital stay and reduction of total cost through the radial approach [8] but due to the learning curve there is a failure rate of 10% [9]. In this study there is no complications observed in radial approach patients.

There are many studies proving the superiority of radial over femoral route, but very few disadvantages are mentioned for radial

Table 9: Domain scores between before and after TRC Visio-spatial abilities.

Domains	Mean	St Dev	P-value
Before TRC visuo-spatial	12.7	2.45	0
After TRC visuo-spatial	9.79	3.22	

Table 10: Sub scores of before and after TRC Visio-spatial.

Sub scores	TRC procedure	Mean	St Dev	P-value
Overlapping pentagons	Before	0.401	0.491	0.012
	After	0.521	0.501	
Wire cube	Before	0.834	0.908	0
	After	0.175	0.567	
Clock	Before	3.81	1.31	0.001
	After	3.26	1.99	
Counting dots	Before	3.71	0.455	0
	After	2.59	1.46	
Identifying letters	Before	3.945	0.229	0
	After	3.24	1.57	

Table 11: Total ACE scores between the before and after TRC.

Domains	Mean	St Dev	P-value
Before TRC ACE score	75.6	11.8	0.326
After TRC ACE score	76.7	10.5	

Table 12: Total MMSE scores between the before and after TRC.

Domains	Mean	St Dev	P-value
Before MMSE score	26.15	1.91	0
After MMSE score	28.11	1.37	

route. More contrast usage, more fluoro time and complexity of the procedure are disproved subsequently [10-20]. The steep learning curve of radial puncture removes that disadvantage also. In fact now during residency many canters are training for radial route only, so these residents are not able to perform femoral puncture well .The dispute on cognitive impairment during TRC is still persisting. To see this effect only this study was performed.

The concept of TRC but not the femoral catheterization may be associated with more cerebrovascular events due to inadvertent entry of the wire easily into carotids through radial route and may raise the plaque with easiness of aortic plaque embolism associated in this route. The previous studies conclude that the cause of the cognitive impairment after PCI was open to conjecture. During cardiac catheterization, CVA may occur with macro-embolism, but there may be very small gaseous and solid cerebral micro-emboli which may not be large enough to cause neurological deficit or stroke, but may effect on cognitive function. So, assessing the cognitive function may be more sensitive test to detect this complication. In TRC patient, MRI may be required only when patient develops significant cognitive impairment.

In our study, the scores of Attention and orientation are more in before procedure (15.3±2.93) compared to after procedure (14.52±3.03) (p=0.006). The scores of memory are more in after procedure (22.28±3.42) compared to before procedure (17.85±5.27) (p=0.000). The scores of fluency are more in before procedure (6.96±2.83) than after procedure (6.01±3.74) (p=0.003). The scores of language are little more in after (24.65±2.28) compared to before (24.3±2.51) (p=0.134) procedure. The scores of visuospatial are

more in before (12.7±2.45) compared to after procedure (9.79±3.22) (p=0.000). The overall ACE scores are more in after procedure (76.7±10.5) compared to before procedure (75.6±11.8) (p=0.326). The MMSE scores are more in after (28.11±1.37) compared to before TRC procedure (26.15±1.91) (p=0.000).

But major problem of using cognitive function for detection of micro-emboli is the effect of anxiety about the procedure on these functions. Usually patients are more anxious before the procedure than after, but are not true always. If patient informed about the severity of CAD and requirement of further treatment, his/her anxiety levels may not come down after procedure, but in fact anxiety may increase. We observed in a results of questionnaire, the patients give their answers for easy questions about their attention, orientation, memory, fluency, visuospatial abilities but the severity of questions are increased the sub scores of domains are decreases, may be due to anxious before and after the procedure.

Conclusion

The cognitive functions were decreased prior to TRC which may be due to the anxiety, as total score increased after TRC. There were no neurological complications and mortality after trans-radial route in this study. The trans-radial catheterization approach is safe and effective.

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