Incompetence of internal jugular valve is associated with mild postoperative cognitive decline in robot-assisted laparoscopic prostatectomy

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Incompetence of internal jugular valve is associated with mild postoperative cognitive decline in robot-assisted laparoscopic prostatectomy

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<ABSTRACT>

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Backgrounds : Internal jugular vein (IJV) is the main pathway of cerebral venous drainage and its valve system prevents retrograde blood flow from the heart to the brain. IJV valve incompetence (IJVVI) is known to be associated with cerebral dysfunctions such as cough syncope and transient amnesia, and it occurs more often in male older than 50 years old and can be aggravated by the conditions elevating intra-abdominal or intra-thoracic pressure. In robot-assisted laparoscopic prostatectomy (RLP), most of the patients are old aged male. Moreover, steep Trendelenburg position and pneumoperitoneum can induce IJVVI, Therefore, we assessed the IJVVI during RLP and compared the cognitive function of the subjects perioperatively.

Methods : 57 patients undergoing RLP were enrolled. Neurocognitive test battery was composed of Mini-Mental State Examination (MMSE), Seoul Verbal Learning Test, Digit Symbol Substitution Test, Korea-Color Word Stroop Test, Digit Span Test (DST), and Grooved Pegboard Test (GPT). Battery was performed on the day before and 2 days after surgery. During surgery, IJVVI was assessed with ultrasonography in supine position without pneumoperitoneum, supine position with pneumoperitoneum, and Trendelenburg position with pneumoperitoneum.

Results : 50 patients underwent sonographic assessment and 34 patients completed both pre- and post-operative neurocognitive examination after withdrawal of 7 patients enrolled. In sonographic assessment, a total of 27 patients (54%) presented IJVVI, 19 patients (38%) in supine position without pneumoperitoneum, 7 patients (14%) in supine position with pneumoperitoneum and 1 patient (2%) in Trendelenburg position with pneumoperitoneum. No IJVVI was seen in 23 patients even in Trendelenburg position with pneumoperitoneum. In neurocognitive examination, patients with IJVVI showed statistically significant decline of score ($p < 0.05$) in MMSE, DST and GPT postoperatively compared to the patients without IJVVI.

However, overall result could be considered clinically insignificant.
Conclusions : IJVVI occurred in 38% of RLP patients but the incidence was increased to 54% as Trendelenburg position and pneumoperitoneum were applied. Patients with IJVVI did not show significant differences in cognitive function test except MMSE, attention and motor coordination. Clinical and neurological significance of physiologic changes associated RLP should be studied further.

Key words : internal jugular valve incompetence, postoperative cognitive dysfunction, robotic surgery

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I. INTRODUCTION

Internal jugular vein (IJV) is the main pathway of cerebral venous drainage and it has valve system to prevent retrograde blood flow to the brain.[1, 2] Physicians have paid great amount of attention to jugular venous pressure for hemodynamic and cerebral perfusion monitoring, however IJV valve (IJVV) abnormality which can affect pressure, has been less-noticed. Anatomical studies revealed that bicuspid or tricuspid valves were located in both jugular veins 2 cm above the subclavia-jugularis bifurcation and 7-18% of the valves were incompetent.[2, 3] Considering the transvalvular pressure, competent canine IJVV could bear 82 mmHg of static pressure and 65 mmHg of pulsatile pressure.[4]

IJVV incompetence (IJVVI) may result in retrograde flow which leads to brain congestion and increase of intracranial pressure, which can cause brain dysfunctions in some patients. IJVVI has been reported to be associated with transient global amnesia (TGA),[5] cough syncope,[6, 7] exertional headache,[8] transient ischemic attack,[9] and air embolism.[10]

Demographic data are associated with the development of IJVVI. Akkawi et al. demonstrated that old age over 50 years and male gender are the risk factors for IJVVI. A few physiologic conditions are related with IJVVI including elevated

intra-thoracic and intra-abdominal pressure,[11] and pulmonary hypertension.[12]

Robot assisted laparoscopic prostatectomy (RLP) is one of the most common robotic surgery because of its significant benefits such as smaller incision, less severe postoperative pain, less intraoperative bleeding, and shorter hospital stay compared to traditional radical prostatectomy.[13-15]The patients undergoing RLP are mostly over 60 years old, have neurologic, cardiac and pulmonary comorbidities. For RLP, patients are in Trendelenburg position most of the time during surgery, which could cause increases in intraabdominal and intrathoracic pressure. Demographic characteristics including old age and male gender, and operative procedure that comprise pneumoperitoneum and steep Trendelenburg position can make RLP patients susceptible to IJVVI, however, it has never been evaluated for these population.

Therefore, we assessed the IJVV incompetence during RLP and compared the cognitive function of the subjects divided by the presence or absence of IJVVI to evaluate its clinical significance.

II. MATERIAL AND METHODS

1. Subjects

Between May 15, 2009 and August 20, 2009, there were total 80 patients undergoing RLP at Severance Hospital at Yonsei University. After approval by the institutional review board, 57 patients gave their written informed consent and were enrolled in the study. Inclusion criteria included patients who were aged 50 years or older, were scheduled for RLP and were ASA class I or II. Patients who had previous neurological deficit, psychiatric diseases, alcoholism or any other drug dependence, serious hearing or visual impairment, and any other comorbidities which would preclude neuropsychological tests were excluded.[16, 17]

2. Perioperative evaluation and Management

Preoperative neurocognitive evaluation was performed the day before the surgery. During surgery, sonographic evaluation for IJVV incompetence was performed. Postoperative neurocognitive evaluation was performed 2 days after the surgery or the day before discharge. Neurocognitive evaluation was performed by same physician to prevent the inter-observer variation.

3. Neurocognitive Assessment

The test battery comprised standard clinical tests to evaluate the cognitive function in different domain including global cognitive function, memory, psychomotor speed, executive function, attention and motor function. This battery was appropriate for use with subjects in the age group studied, required minimal sensory or motor demands. Total administration time was approximately 30 minutes.

A. Mini-Mental State Examination, Korean version (MMSE)

This is a screening test for global cognitive function, espcially useful to screen dementia. It consists of 6 categories of questionnaires including arithmetic, memory, and orientation. The score 24 or more out of 30 is considered to be normal.

B. Auditory Verbal Learning Test, Korean version (AVLT)

This assesses global memory of the examinee. There are 12 words in the examination. The examiner presents each word every 2 second in a same voice tone. Then the patient delivers the words he or she can remember. Repeat the process above 2 more times, which can assess immediate recall. After 20 minutes, the patient is supposed to deliver the words he or she can remember, which can measure delayed recall. Finally, patient is asked to find the words presented before in the words combined with new other words. This can evaluate recognition. The number of words correctly delivered by the patient was recorded.

C. Digit Symbol Substitution Test (DSST)

This test assesses visual attention, concentration, high level of motor function, tracking ability. It consists of 9 digit-symbol pairs followed by a list of digits. Under each digit, the examinee should write down the corresponding symbol as fast as possible. The number of correctly written symbols within 90 seconds was scored.

D. Color Word Stroop Test, Korean version (CWST)

This test is able to evaluate the executive functions of inhibition, selective attention, mental speed and interference susceptibility. This test consists of 2 sections. The first test presents a list of color words printed in an incongruous color and requires that the examinee named the word while ignoring the color. The second test exhibits another list printed in a same manner and requires that the examinee name the color while ignoring the word. The obtained scores are the number of words correctly named in 120 seconds each, the number of error and time to finish the each test.

E. Digit Span Test (DST)

This test can measure attention span to verbal stimulation, concentration, working memory. This consists of 2 subsets, which are forward and backward reciting of numbers delivered by the examiner. In the first part of the test, the

examiner presents a number every 1 second in a same row. Then the patient recites forward the numbers presented by the examiner. If the patient answers correctly, the examiner presents the numbers in the next row until the patient is not able to recite correctly. In the second part, the patient recites backward the numbers presented. The forward and backward reciting numbers are scored in total.

F. Grooved Pegboard Test (GPT)

This test is to evaluate the visual-motor coordination, motor function. The test board consists of 25 holes with randomly positioned slots. Pegs with a key along one side must be rotated to match the hole before they can be inserted. The test is performed with the dominant hand, then with the non-dominant hand. The time taken to insert the 25 pegs, the number of errors are recorded.

4. Anesthesia

Anesthesia was induced with intravenous propofol (1–1.5mg/kg), remifentanil (0.3-0.5 mg/kg/min) and rocuronium (0.6 mg/kg). Ventilator was adjusted to maintain inspiratory plateau pressure less than 30 cm H_2O (tidal volume at 8 mL/kg of ideal body weight or pressure controlled ventilation with inspiratory pressure of 28 cmH_2O during pneumoperitoneum) with 50% of inspired oxygen fraction of oxygen-air mixture. Respiratory rate was adjusted to maintain an end-tidal CO2 ($ETCO_2$) pressure of 35 – 40 mmHg. After anesthesia induction, the abdominal cavity was insufflated with CO_2 gas pressure set to 15 mmHg and then patients were placed in a 30 degree Trendelenburg position during surgery. Anesthesia was maintained with 1 minimum alveolar concentration of sevoflurane and remifentanil (0.1–0.2 mg/kg/ min). The surgeon performed the procedure at a control console located in the other side of operating room away from the operating table using the da Vinci robot surgical system (Intuitive Surgical, Sunnyvale, CA).

5. Sonographic Assessment

Bilateral IJVV were examined with 10 MHz linear array transducer (Vivid-i, GE medical, Milwaukee, USA). The jugular blood flow direction was assessed with color Doppler and pulsed-wave Doppler at the head of the valves. The examination was performed after induction in supine, pneumoperiteneum, and Trendelenburg position. Continuous retrograde flow more than 0.88 second at any side was considered to be positive for IJVVI.

6. Statistical analysis

Statistical analysis was performed using SPSS version 12.0 (SPSS Inc., Chicago, IL). All data are expressed as mean ± SD. Neurocognitive test results before and after the surgery were analyzed with ANOVA. The difference between preoperative value and postoperative value was analyzed, too. A value of P less than 0.05 was considered as statistically significant.

III RESULTS

A total of 57 patients planning to have RLP were assessed for this study. Seven patients were excluded for cancellation of surgery or refusal to take the postoperative evaluation because of postoperative pain after surgery. Therefore a total number of 50 patients underwent sonographic evaluation of IJVVI during the surgery. Among them, 34 patients completed pre- and post-operative neurocognitive assessments.

Sonography identified bilateral valves in 45 subjects and unilateral valve in 5 patients. Nineteen patients (38%) showed IJVVI in supine position, and additional seven patients (14%) demonstrated IJVVI after pneumoperitoneum. Only one patient showed IJVVI after Trendelenburg position and pneumoperitoneum. The rest of twenty three patients (46%) did not demonstrate IJVVI even after Trendelenburg position and peumoperitoneum.

To compare cognitive function, we classified twenty three patients who didn't show IJVVI as Group N and nineteen patients who showed IJVVI in supine position as Group S. The patients who showed IJVVI after pneumoperitoneum or Trendelenburg position were classified as Group PT.

There were no significant differences of demographic data among groups (Table 1). Patients' age ranged between 56 and 78 years old.

Table 1. Patients' characteristics

	Group N	Group PT	Group S	P value
Age	67 ± 5.4	66 ± 6.5	68 ± 4.7	0.73
Height (cm)	166.7 ± 5.1	166.6 ± 4.2	165.9 ± 5.9	0.34
Weight (kg)	67.3 ± 5.9	67.4 ± 5.4	63.3 ± 10	0.27
Operation time (minute)	175 ± 36.5	187.9 ± 52.7	180 ± 40.8	0.77
Anesthesia time (minute)	221 ± 38.3	221.4 ± 35.1	236.5 ± 49.8	0.55

Values are expressed as mean ± SD. Group N: no internal jugular vein valve

incompetency (IJVVI). Group PT: IJVVI after pneumoperitoneum or Trendelenburg. Group S: IJVVI in supine.

Neurocognitive tests, MMSE scores were comparable among the groups before the operation (Table 2). But Group PT and S showed decrease of MMSE score after the surgery, while Group N maintained the score ($p = 0.04$). Group S showed significantly lower MMSE score after the surgery ($p = 0.02$) comparing to the Group 0, however that of Group PT did not reached statistical significance comparing to Group N ($p = 0.31$).

Table 2. Mini-Mental Status Examination

	Preop	Postop	Difference
group N	28 ± 1	28 ± 1	0.3 ± 0.9
group PT	28 ± 2	27 ± 2	-1.3 ± 0.7
group S	27 ± 2	26 ± 2	-1.3 ± 2.6

Values are expressed as mean ± SD. Group N: no internal jugular vein valve incompetency (IJVVI). Group PT: IJVVI after pneumoperitoneum or Trendelenburg. Group S: IJVVI in supine.

AVLT, DSST and CWST demonstrated no significant difference among the groups.

Table 3. Auditory Verbal Learning Test

		Preop	Postop	Difference
Immediate recall	group N	16 ± 4	21 ± 6	4.1 ± 3.3
	group PT	17 ± 5	20 ± 5	3.1 ± 4.1

	group S	15 ± 4	19 ± 6	4.4 ± 5.1
Delayed recall	group N	5 ± 2	6 ± 2	1.1 ± 1.1
	group PT	5 ± 3	6 ± 3	0.6 ± 1.8
	group S	4 ± 2	6 ± 3	1.6 ± 1.5
Recognition	group N	20 ± 2	20 ± 2	-0.2 ± 1.3
	group PT	20 ± 2	20 ± 2	-0.8 ± 1.5
	group S	20 ± 2	20 ± 3	-0.3 ± 2.7

Values are expressed as mean ± SD. Group N: no internal jugular vein valve incompetency (IJVVI). Group PT: IJVVI after pneumoperitoneum or Trendelenburg. Group S: IJVVI in supine.

Table 4. Digit Symbol Substation Test

		Preop	Postop	Difference
Correct number	group N	34 ± 12	32 ± 12	-0.9 ± 5.0
	group PT	34 ± 8	39 ± 7	3.3 ± 4.0
	group S	36 ± 12	33 ± 11	-2.5 ± 6.2
Correct number/sec	group N	0.4 ± 0.1	0.4 ± 0.1	-0.0 ± 0.5
	group PT	0.4 ± 0.1	0.4 ± 0.1	0.4 ± 0.4
	group S	0.4 ± 0.1	0.4 ± 0.1	-0.0 ± 0.1
Error	group N	0.4 ± 0.8	0.6 ± 1.3	0.2 ± 1.1
	group PT	0.1 ± 0.4	0.2 ± 0.4	0.0 ± 0.0
	group S	0.0 ± 0.0	0.5 ± 1.1	0.5 ± 1.1

Values are expressed as mean ± SD. Group N: no internal jugular vein valve incompetency (IJVVI). Group PT: IJVVI after pneumoperitoneum or Trendelenburg. Group S: IJVVI in supine.

Table 5. Color World Stroop Test

	Preop	Postop	Difference

Word	Correct number	group N	109 ± 8	109 ± 11	0.4 ± 12.5
		group PT	112 ± 0	112 ± 0	-0.2 ± 0.4
		group S	112 ± 1	110 ± 3	-0.9 ± 3.1
	Correct number/sec	group N	1.5 ± 0.5	1.3 ± 0.4	-0.1 ± 0.3
		group PT	1.6 ± 0.2	1.6 ± 0.2	-0.1 ± 0.3
		group S	1.5 ± 0.3	1.4 ± 0.4	-0.2 ± 0.1
	Error	group N	0.2 ± 0.5	0.1 ± 0.3	-0.1 ± 0.3
		group PT	0.0 ± 0.0	0.3 ± 0.5	0.3 ± 0.5
		group S	0.2 ± 0.6	0.3 ± 0.6	0.1 ± 0.5
Color	Correct number	group N	82 ± 27	75 ± 24	-4.3 ± 13.8
		group PT	91 ± 19	96 ± 16	0.3 ± 6.1
		group S	72 ± 19	71 ± 24	-1.2 ± 13
	Correct number/sec	group N	0.7 ± 0.2	0.6 ± 0.2	-4.0 ± 0.13
		group PT	0.8 ± 0.2	0.8 ± 0.1	-0.0 ± 0.1
		group S	0.6 ± 0.2	0.6 ± 0.2	-0.0 ± 0.1
	Error	group N	2.3 ± 2.8	2.1 ± 2.3	-0.2 ± 2.5
		group PT	2.0 ± 3.2	2.7 ± 2.8	0.5 ± 3.2
		group S	1.8 ± 3.1	2.5 ± 3.0	0.6 ± 1.7

Values are expressed as mean ± SD. Group N: no internal jugular vein valve incompetency (IJVVI). Group PT: IJVVI after pneumoperitoneum or Trendelenburg. Group S: IJVVI in supine.

DST was comparable among the groups before and after the surgery (Table 6). But the differences between preoperative and postoperative DST-forward value showed statistical significance ($p = 0.02$). The number of correct answers in DST increased in Group N and Group PT, while Group S showed decreased

number of correct answers (p = 0.03: Group N vs Group S, p = 0.04: Group PT vs Group S). Postoperative changes in DST-forward were not different in Group N and PT.

Table 6. Digit Span Test

		Preop	Postop	Difference
Forward*	group N	7.3 ± 1.4	7.3 ± 1.6	0.3 ± 0.7
	group PT	6.9 ± 1.7	7.3 ± 1.6	0.5 ± 1.1
	group S	7.4 ± 1.0	6.7 ± 1.2	-0.7 ± 1.1
Backward	group N	3.8 ± 1.3	3.6 ± 1.0	0.1 ± 0.8
	group PT	3.3 ± 0.8	3.7 ± 1.6	0.3 ± 1.0
	group S	3.6 ± 0.8	3.3 ± 0.8	-0.4 ± 1.1

Values are expressed as mean ± SD. Group N: no internal jugular vein valve incompetency (IJVVI). Group PT: IJVVI after pneumoperitoneum or Trendelenburg. Group S: IJVVI in supine. *: $p < 0.05$ analyzed by ANOVA.

GPT with dominant hand took comparable time among the groups before and after the operation (Table 7). The time differences were significantly longer in Group S comparing to Group N (p=0.22). However, there was no significant differences in Group S and Group PT (p = 0.09).

Table 7. Grooved Pegboard Test

			Preop	Postop	Difference
Dominant	Time*	group N	95 ± 23	99 ± 29	0.3 ± 14.9
		group PT	85 ± 19	80 ± 9	1.0 ± 9.9
		group S	93 ± 21	111 ± 41	20.6 ± 24.3

		group N	0.1 ± 0.4	0.5 ± 0.9	0.4 ± 1.1
	Drop	group PT	0.4 ± 0.5	0.3 ± 0.5	-0.2 ± 0.8
		group S	0.5 ± 0.7	0.6 ± 0.7	0.0 ± 1.1
		group N	0.3 ± 0.6	0.1 ± 0.3	-0.3 ± 0.8
	Fail	group PT	0.1 ± 0.4	0.2 ± 0.4	0.2 ± 0.4
		group S	0.5 ± 1.1	0.5 ± 0.8	-0.2 ± 1.3
		group N	110 ± 47	111 ± 37	-1.1 ± 48.5
	Time	group PT	88 ± 14	96 ± 10	10.8 ± 15.4
		group S	98 ± 17	104 ± 22	9.5 ± 10.3
		group N	0.2 ± 0.4	0.4 ± 1.0	0.2 ± 1.1
Nondominant	Drop	group PT	0.6 ± 1.0	0.5 ± 0.8	-0.2 ± 1.3
		group S	0.5 ± 0.5	0.4 ± 0.7	-0.2 ± 0.8
		group N	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0
	Fail	group PT	0.1 ± 0.4	0.0 ± 0.0	0.0 ± 0.0
		group S	0.5 ± 1.4	0.4 ± 0.9	-0.3 ± 1.9

Values are expressed as mean ± SD. Group N: no internal jugular vein valve incompetency (IJVVI). Group PT: IJVVI after pneumoperitoneum or Trendelenburg. Group S: IJVVI in supine. *: $p < 0.05$ analyzed by ANOVA.

Comparing the neurocognitive function between two groups, which were patients with IJVVI and ones without IJVVI, there were no significant difference between 2 groups except MMSE (p=0.01)

IV. DISCUSSION

The aim of this study was to evaluate the prevalence of IJVVI in RLP population and its influence on postoperative cognitive function. According to the result of this study, the prevalence of IJVVI was 38% in RLP patients, which was compatible with the previous results.[5, 8, 18] But 26% (8/31) of the patients who showed no IJVVI in supine position, demonstrated IJVVI after pneumoperitoneum or Trendelenburg position. We assume that latent valvular abnormality may come out by increased transvalvular pressure gradient induced by Trendelenburg position or pneumoperitoneum. The fact that deserves our notice is that adding Trendelenburg position to pneumoperitoneum produced IJVVI in only one additional patient out of eight. Considering that 20 degree of Trendelenburg position increased IJV pressure from 9 to 17 mmHg in a research,[19] we can incur that 15 mmHg of pneumoperitoneum and 30 degree of Trendelenburg position have similar effect on transvalvular pressure gradient and applying both maneuvers simultaneously does not make serious change in evaluation of jugular valve function.

IJVVI allows venous congestion and cerebral hypoperfusion, which may result in several neurologic diseases, such as TGA, headache, respiratory brain syndrome, and iatrogenic venous air embolism. IJVVI is found in 7-18% of cadaveric researches and 29-45% of general population, and more common in elderly subjects. Patients undergoing LRP are usually over 50 years old and have increased intraabdominal and intrathoracic pressure throughout the surgery, which put them prone to encounter IJVVI during surgery.

The neurologic deficits associated with IJVVI are thought to be caused by cerebral hypoperfusion. Equalization of arterial and central venous pressure was demonstrated in an IJVVI patient whose symptom was cough syncope.[20] Acute rise of intrathoracic pressure induced by cough could be delivered into the intracranial veins directly in IJVVI patients and increase intracranial pressure, therefore, decrease cerebral blood flow. Cerebral perfusion pressure could be

abruptly dropped by increased intracranial pressure. This phenomenon was not seen in a healthy volunteer.[11]

Trendelenberg position and pneumoperitoneum are known to be associated with increased intracranial pressure.[21, 22] However, their effect on cerebral perfusion is unclear because Trendelenburg position increases arterial pressure as well as intracranial pressure. There have been two clinical studies that investigated cerebral perfusion during laparoscopic surgery. Increased regional cerebral oxygen saturation which represents cerebral perfusion was noted in one research using 30 degrees Trendelenburg and 15 mmHg pneumoperitoneum,[23] while the other study demonstrated decrement of regional cerebral oxygen saturation with pneumoperitoneum and Trendelenburg position in an additive manner.[24]

Transient ischemic insult to the brain is usually benign, but may yield cognitive impairment over prolonged period. Borroni et al. demonstrated that 33% of transient global amnesia patients had demonstrated mild cognitive impairment worse performances on verbal and non-verbal long-term memory and attention.[25]

The result of the present study suggests neurocognitive dysfunction can happen by IJVVI in RLP patients. Although there is no conclusive definition of postoperative cognitive dysfunction (POCD), it is prevalent presented early posteoprative period around 7 days after surgery. POCD usually shows impairment in memory, attention, concentration, learning and speed of visual-motor response.[26] Patients who are elderly, have a history of previous cerebrovascular attack, alcohol abuse, have major surgery are more susceptible to have POCD.[17, 26, 27] Overall prevalence is reported 25% at 1 week, 10 % at 3 months after surgery.[28] Although memory did not show significant changes, attention, concentration represented as DST, visual-motor response represented by GPT, global cognitive function represented as MMSE decreased in the patients having IJVVI. Noticeably, those showing IJVVI after

pneumoperitoneum or Trendelenburg position had similar decrement of MMSE score comparing to the patients who showed IJVVI in the supine position. That suggests simple sonographic test may be insufficient to detect jugular valve dysfunction which influences postoperative cognitive function. POCD can be newly presented 3 months after surgery, especially in the elderly.[17] Therefore, long-tern follow-up for neurocognitive evaluation may reveal greater differences between groups.

Except small but significant changes in MMSE, GPT, and DST, overall neurocognitive function tests revealed no differences among the patients irrespective of IJVVI. Even in some patients, test results were improved after the surgery. There are a few explanations about this. First of all, we performed the tests in 3 or 4 day period, and it is very short time for the patient to forget the previous test. Learning effect may bias the result of neurocognitive tests in this study[26]. Psychiatrists usually recommend the testers to have 3-6 months period to repeat the cognitive function test. But our aim was to detect acute change yielded by IJVVI in RLP patients, it was not adequate to have longer time to repeat the tests. .[17]

Ultrasonography is a simple and easy bedside procedure to detect IJVVI. There are a few ways to qualify or quantify the magnitude of regurgitant flow. Pulsed wave Doppler can detect the duration of flow[29] and using contrast or Valsalva maneuver exaggerate the small regurgitation to an enough level to detect.[30] We identified IJVVI with color Doppler first and then measured the duration of regurgitant flow using pulsed wave Doppler. Physiologic backward flow of short duration can be detected in normal competent valves, therefore, we adopted the value of 0.88 sec for the diagnostic criteria to detect persistent retrograde flow after the closure of the valves.

Another limitation of this study is that we didn't measure central venous pressure invasively. Of course, it is ideal to measure the pressure directly and compare it with valve functions, but it was impossible to cannulate jugular

valve for fear of valve damage.[31] The relationship between CVP and IJVVI incurs further study.

V. CONCLUSIONS

IJVVI occurred in 54% of RLP patients during the surgery, while 38% of patients were detected in supine position. Additional 16% of patients showed IJVVI due to the physiologic effect of pneumoperitoneum and Trendelenburg position. The presence of IJVVI was associated with small decrement of global cognitive function represented by MMSE, attention represented by DST, and coordination represented by GPT. However, overall neurocognitive dysfunction can be considered as insignificant irrespective of IJVVI.

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< ABSTRACT (IN KOREAN)>

로봇 전립선절제술 환자에서 내경정맥 판막부전과 수술 후 인지기능 장애의 연관성에 대한 고찰

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노고운

서론 : 내경정맥은 뇌혈류가 심장으로 환류되는 주된 경로로, 그 원위부에는 판막이 존재해 심장으로부터 뇌로 혈액이 역류하는 것을 방지하는 역할을 한다. 그러나 남자, 50세 이상, 두부하방자세를 하거나 복강내압, 흉강내압이 증가된 환자의 경우 내경정맥 판막의 부전이 호발할 수 있으며 이는 뇌의 울혈, 뇌압 상승을 초래해 결과적으로 뇌기능의 장애를 유발할 수 있다. 최근 가장 널리 시행되는 로봇수술 중의 하나인 로봇 전립선절제술을 시행하는 환자의 경우, 대부분이 60세 이상이며 다양한 신경학적 질환이나 심폐질환을 동반한 경우가 흔하다. 이에 더불어 수술 중 장시간 동안 두부하방자세를 유지한 채로 기복을 유도해 수술을 하게 된다. 위와 같은 특징에 의해 로봇 전립선절제술을 시행 받는 환자는 내경정맥 판막부전이 호발할 수 있는 위험요소를 가지게 되나 이와 관련된 연구는 행해진 적이 없다. 따라서 본 연구에서는 수술 중 내경정맥 판막부전 빈도와 그 유무에 따른 인지기능의 변화를 비교해 보았다.

재료 및 방법 : 로봇 전립선절제술이 예정된 57명의 환자를 대상자로 선정하였다. 수술 하루 전, 수술 후 2일에 총 6가지로 구성된 인지기능 검사를 시행하였다. 수술 중에는 초음파를 통해 앙와위, 두부하방자세, 기복을 시행한 상태에서 각각 내경정맥 판막부전에 대한 검사를 시행하였다.

결과 : 대상자 중 50 명의 환자에서 초음파검사를 시행하였고, 이 중 34명의 환자가 수술 전, 후 인지기능 검사를 완료하였다. 초음파검사상, 총 27명 (54%)에서 내경정맥 판막부전이 관찰되었는데, 이 중 19명은 앙와위에서, 7명은 두부하방자세를 하거나 앙와위에서 기복을 유도한 후, 1명은 두부하방자세에서 기복을 유도한 후 판막부전을 관찰할 수 있었다. 인지기능검사상, 앙와위에서 판막부전을 보인 환자에서 한국판 간이 정신상태검사, 기호바꿔쓰기, 홈패인 펙보드 검사에서 다른 군과 통계학적으로 유의한 차이를 보였다 ($p < 0.05$). 그러나 전반적인 인지기능 검사상의 결과는 비특이적이었다.

결론 : 수술 전후 인지기능검사의 결과는 내경정맥 판막부전에 따라 임상적으로 유의한 차이를 보이지는 않았다. 그러나 두부하방자세, 기복 유도 시 앙와위에서 보다 판막부전의 유병율이 더 크게 나타나는 것을 관찰할 수 있었다. 따라서 이러한 생리적 변화의 임상적 중요성에 대한 추후 연구가 필요하겠다.

핵심되는 말 : 내경정맥 판막부전, 수술 후 인지기능장애, 로봇 수술