葉大偉 醫師

現任：
新竹台大分院新竹醫院耳鼻喉部主治醫師
經歷：
台大醫院新竹分院耳鼻喉部主任
行政院衛生署新竹醫院耳鼻喉科主任
葉大偉耳鼻喉科診所院長
省立新竹醫院耳鼻喉科主治醫師
省立新竹醫院耳鼻喉科住院醫師
中國醫藥大學醫學系畢業

吳靖農 (Ching-Nung Wu, MD)

現職

- 高雄長庚醫院 耳鼻喉部 講師級主治醫師

學歷

- 中國醫藥大學 醫學系（2011 年畢）
- 成功大學 公共衛生研究所博士班（進修中）

經歷

- 中國醫藥大學附設醫院 實習醫師
  (Best Intern Award)
- 高雄長庚醫院 畢業後一般醫學訓練
- 高雄長庚醫院 耳鼻喉部 住院醫師
  （最佳服務優良人員）

近期代表著作

Current and Future Treatments for External Auditory Canal Cancer.
Wu CN, Liu TT, Yang CH, Hwang CF.
International Journal of Head and Neck Science, 4: 78-91, 2019. doi:10.6696/IJHNS.201906_3(2).0002

Eligibility for live, interactive otolaryngology telemedicine: 19-month experience before and during the COVID-19 pandemic in Taiwan.
Wu CN, Luo SD, Lin HC, Huang JT, Lee CH, Liu SY, Tsai MH, Wang CC, Fan S, Wang PS, Lan KC.
Biomed J. 2021 Aug 7:S2319-4170(21)00100-1. doi: 10.1016/j.bj.2021.07.012. Epub ahead of print. PMID: 34371224.

Angiotensin II receptor blockers and oral squamous cell carcinoma survival: A propensity-score-matched cohort study.
Wu CN, Wu SC, Chen WC, Yang YH, Chin JC, Chien CY, Fang FM, Li SH, Luo SD, Chiu TJ.
PLoS One. 2021 Dec 2;16(12):e0260772. doi: 10.1371/journal.pone.0260772.

Applicability of Oculomotor Tests for Predicting Central Vestibular Disorder Using Principal Component Analysis.
Wu CN, Luo SD, Chen SF, Huang CW, Chiang PL, Hwang CF, Yang CH, Ho CH, Cheng WD, Lin CY, Li YL.
J Pers Med. 2022 Feb 2;12(2):203. doi: 10.3390/jpm12020203.

Clinical Significance of the Neural Response Telemetric Thresholds in Mandarin-speaking Cochlear Implant Patients.
Wu CN, Yang CH, Huang P, Huang YW, Hwang CF.
J Chin Med Assoc. 2022 Mar 9. doi: 10.1097/JCMA.0000000000000707. Epub ahead of print.

著作翻譯

El Gandy, M. S., & Tyler, R. S. (2014). Relief Strategies for Hyperacusis. Journal of the Speech-Language- Hearing Association of Taiwan, 39, 1-13. doi:10.6143/JSLHAT.201812_39.0001.
吳靖農、黃仲鋒。聽覺過敏的緩解策略。台灣聽力語言學會雜誌 第40期(2019年6月) pp.1-12

智慧財產權及應用成果

中華民國發明專利：利用深度學習分析眼振感測資料的方法及眼振感測分析系統
專利號碼：I746381　發明人：**吳靖農**、羅盛典、范佐搖、陳嶽鵬、郭昶甫

眼振檢查於中樞型眩暈之分析及未來發展

頭暈讀書會分享

吳靖農 醫師

高雄長庚醫院 耳鼻喉部 助理教授級 主治醫師

成功大學 公共衛生所 博士班

急性眩暈就診

盛行率 20-56%

2.6×10^6 人/年(US)

-耳部前庭疾病

-**中樞血管**疾病

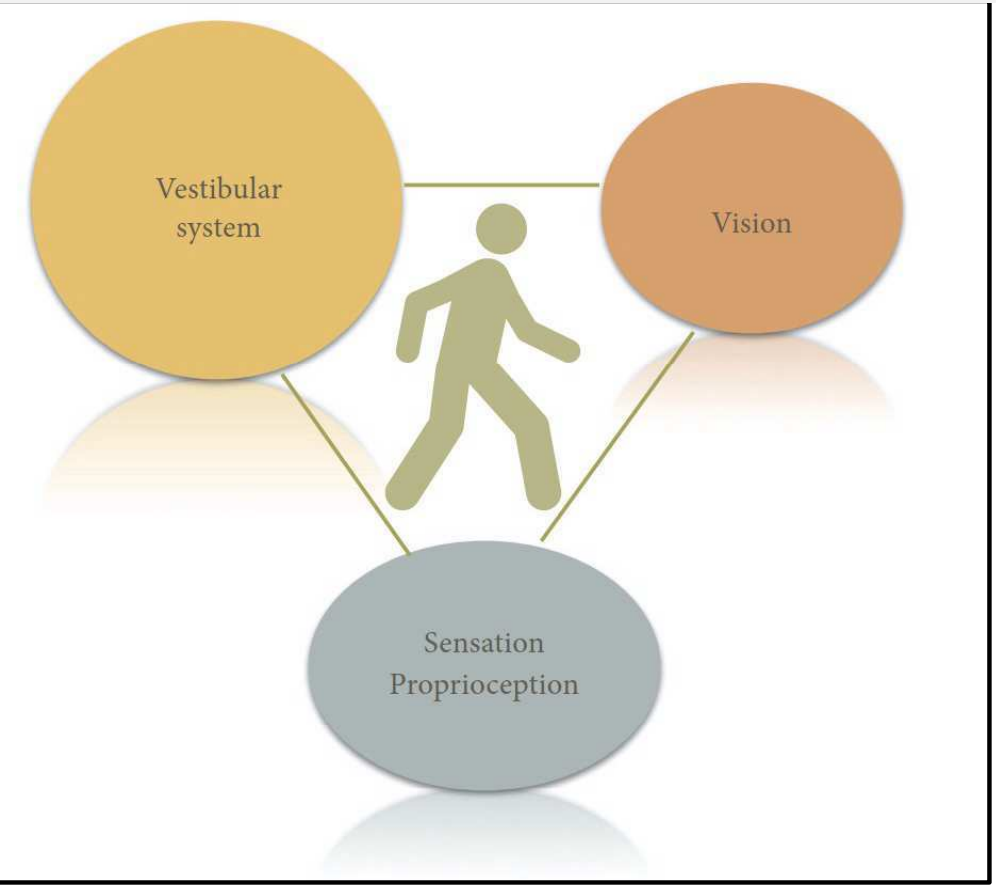
1.無立即/簡便篩檢

2.易產生醫療糾紛

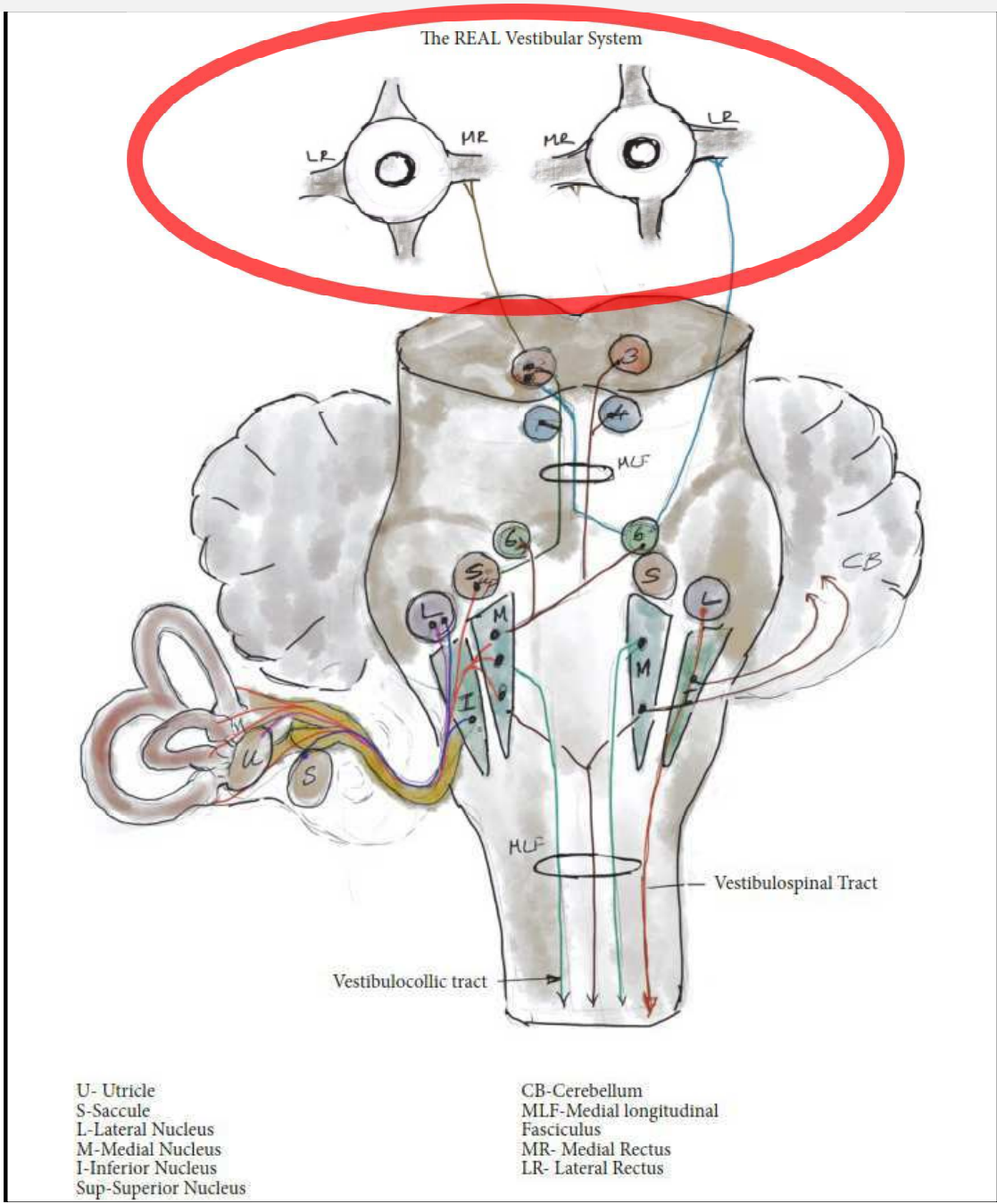
Teggi R, et al. Acta Otorhinolaryngologica Italica . 2016;36:215-219.

Kerber KA, et al. Acad emerg med 2008;15:744-50.

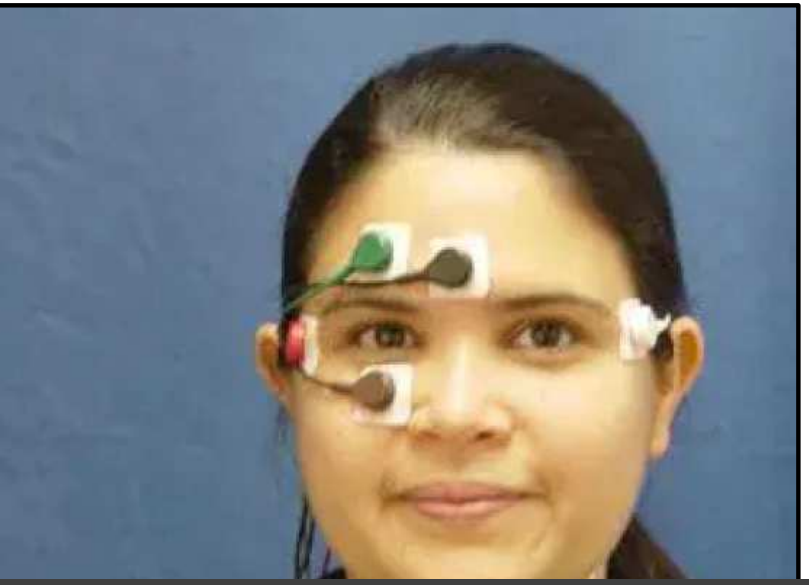
Balance System



Renga V. Clinical Evaluation of Patients with Vestibular Dysfunction. Neurol Res Int. 2019:3931548.



ENG vs. VNG



Less artifacts
Torsional eye movements

Pietkiewicz, Piotr, et al. International journal of occupational medicine and environmental health 25.1 (2012): 59-65.

Videonystagmography (VNG)

Oculomotor evaluation

- ✓ Gaze stability test
- ✓ Saccade evaluation
- ✓ Smooth pursuit trackin
- ✓ Optokinetic test

Spontaneous nystagmus

Positional / Positioning test

Headshake test

Caloric irrigation test

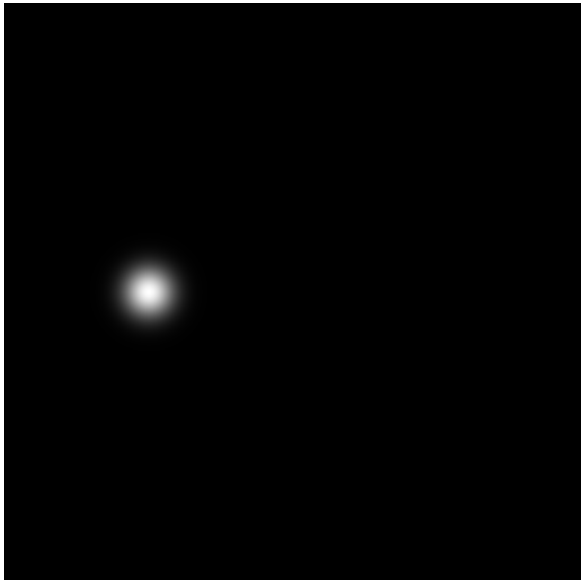
Videonystagmography (VNG)

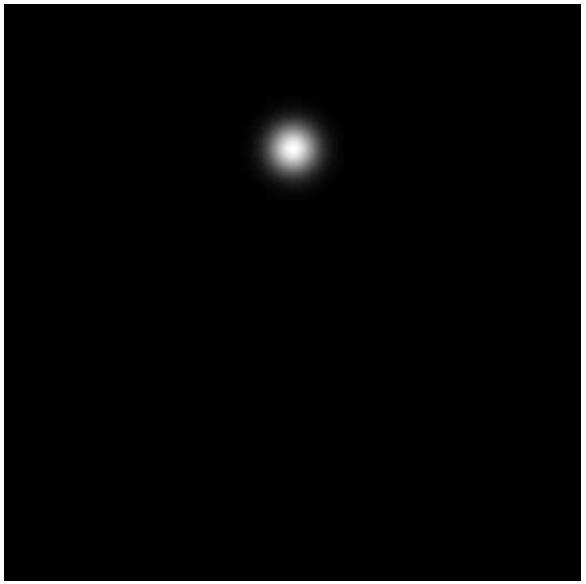
Oculomotor evaluation

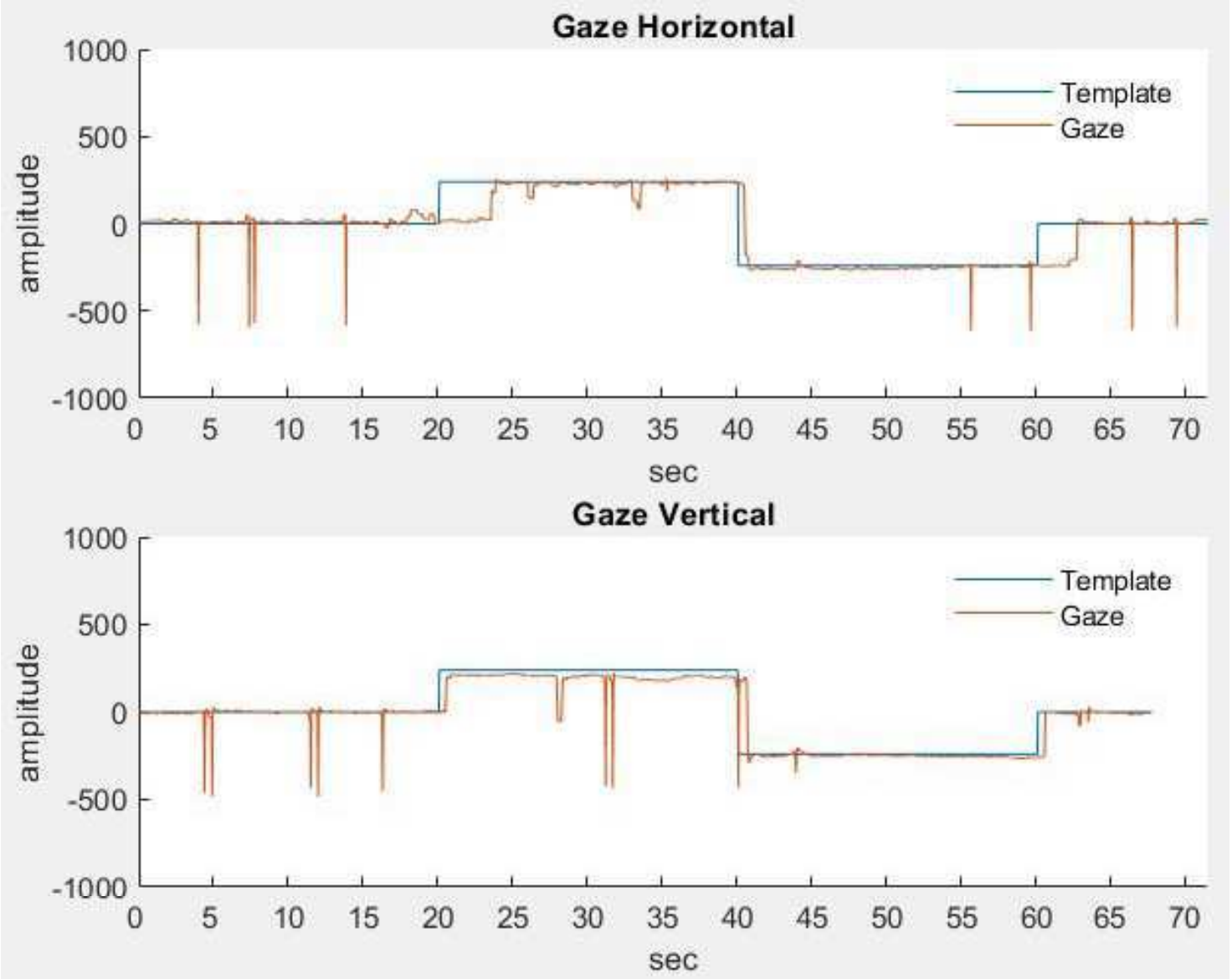
- ✓ **Gaze stability test**
- ✓ **Saccade evaluation**
- ✓ **Smooth pursuit tracking**
- ✓ **Optokinetic test**

Central Lesions

Gaze stability test







Gaze stability test

Central lesion

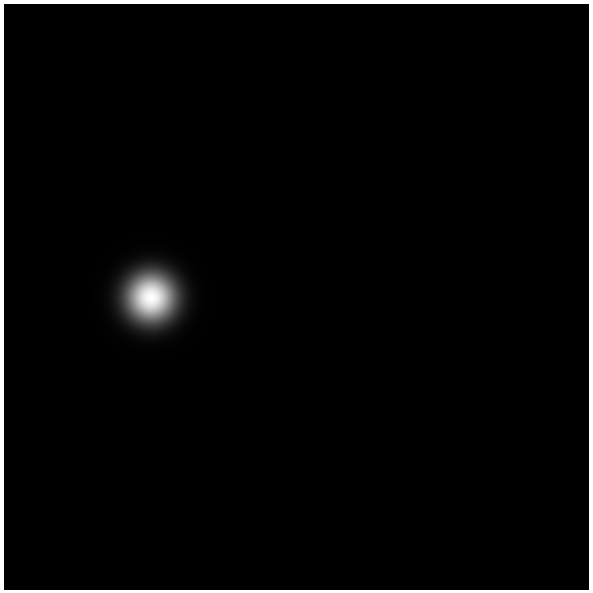
- ✓ **Change direction with change in gaze direction**
- ✓ **Bi-directional nystagmus**
- ✓ **Up-beating nystagmus**
- ✓ **Down-beating nystagmus in any gaze position**

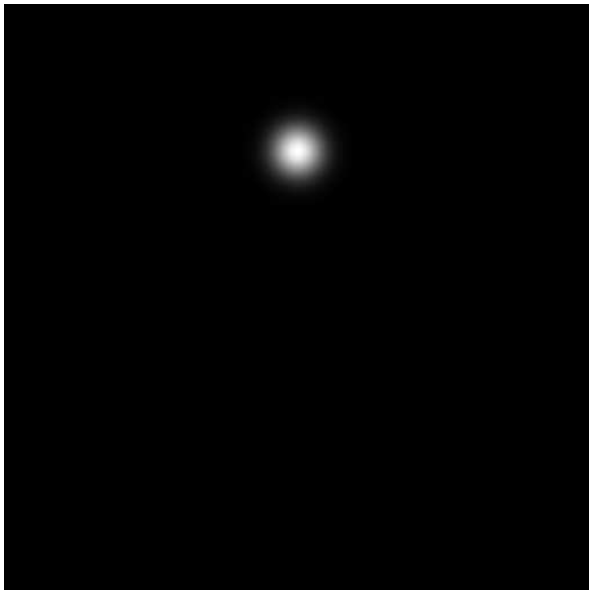
Peripheral lesion

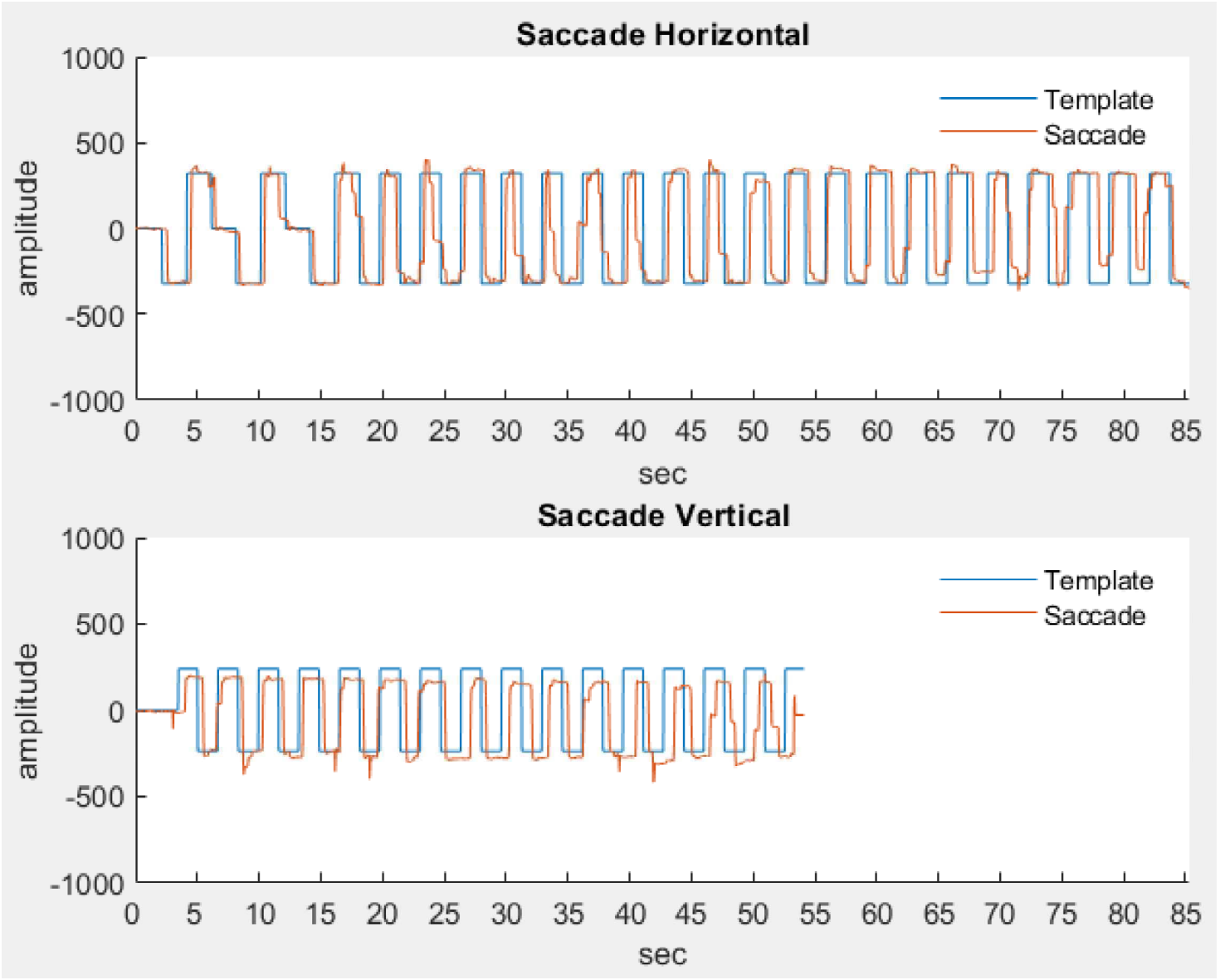
- ✓ **Direction fixed**
- ✓ **Suppressed by visual fixation**

Johnson, Jonas. Bailey's head and neck surgery: Otolaryngology. Lippincott Williams & Wilkins, 2013.
Jacobson, Gary P., et al. Jacobson GP, Shepard NT. Balance function assessment and management. San Diego: Plural (2008): 27-44.

Saccade evaluation



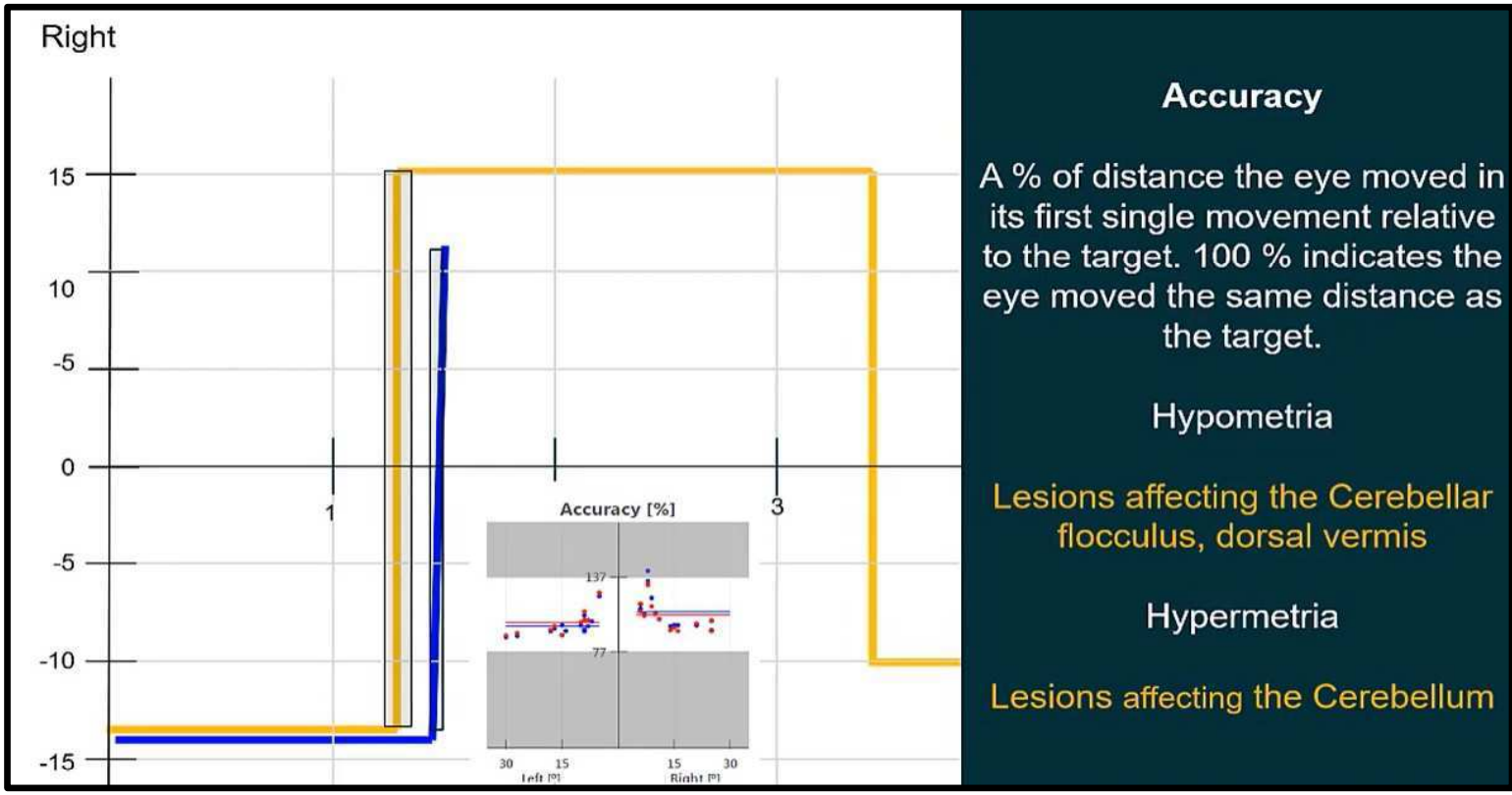




Saccade evaluation

Central lesion, for localization

- ✓ **Saccade accuracy**
- ✓ Saccade latency
- ✓ Saccade velocity

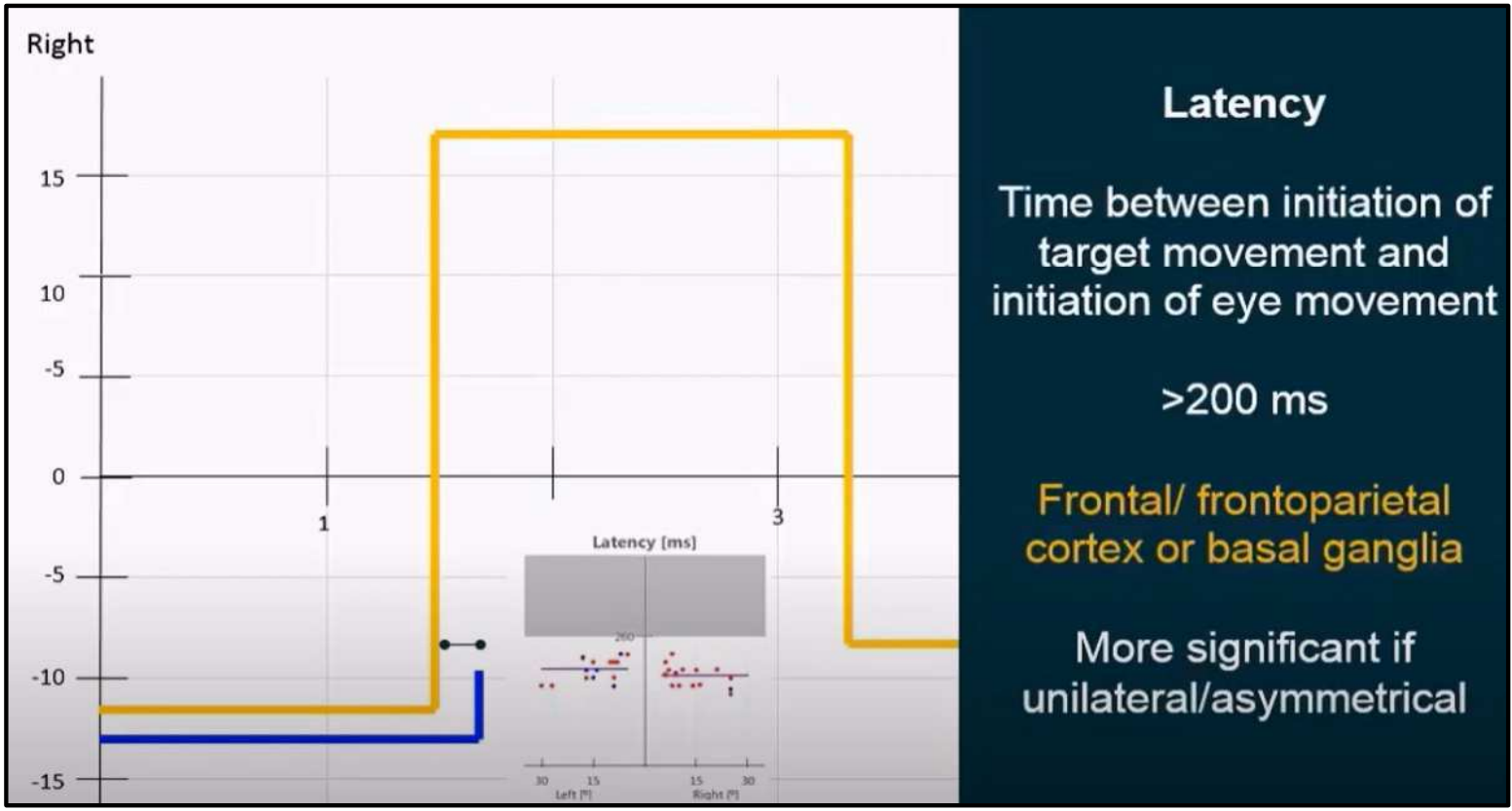


Jacobson, Gary P., et al. Jacobson GP, Shepard NT. Balance function assessment and management. San Diego: Plural (2008): 27-44.

Saccade evaluation

Central lesion, for localization

- ✓ Saccade accuracy
- ✓ **Saccade latency**
- ✓ Saccade velocity

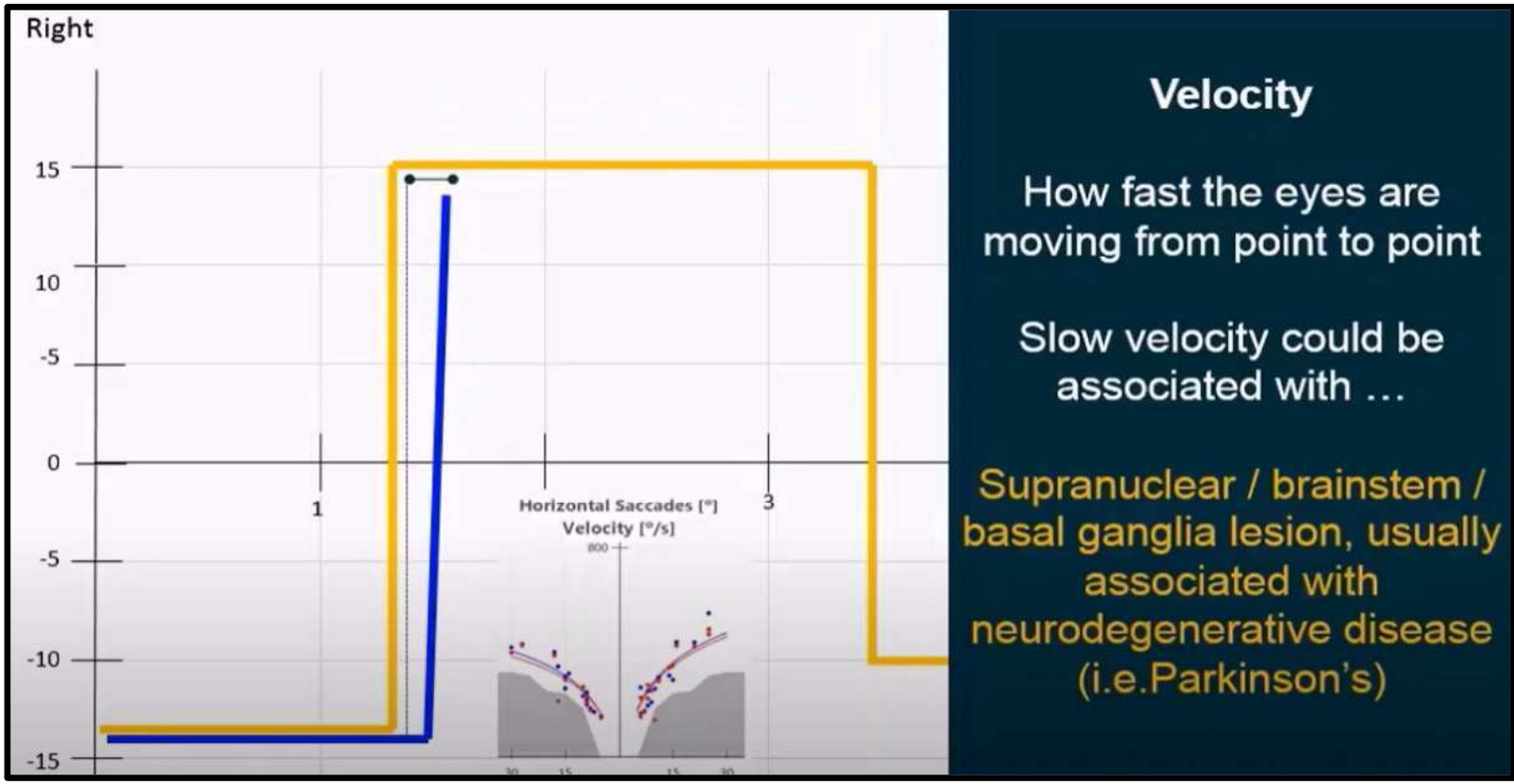


Jacobson, Gary P., et al. Jacobson GP, Shepard NT. Balance function assessment and management. San Diego: Plural (2008): 27-44.

Saccade evaluation

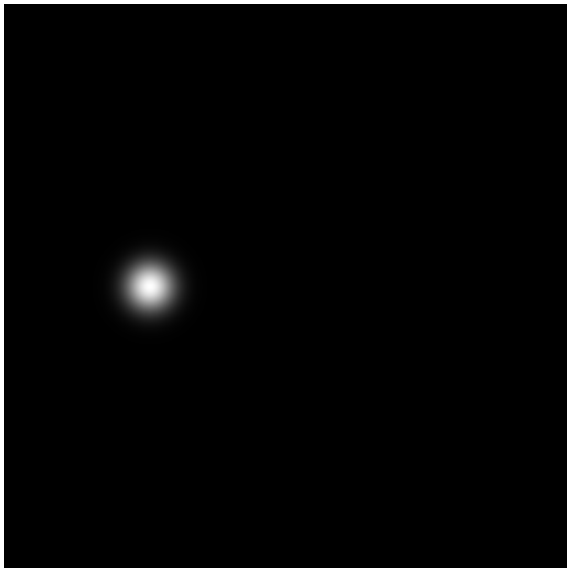
Central lesion, for localization

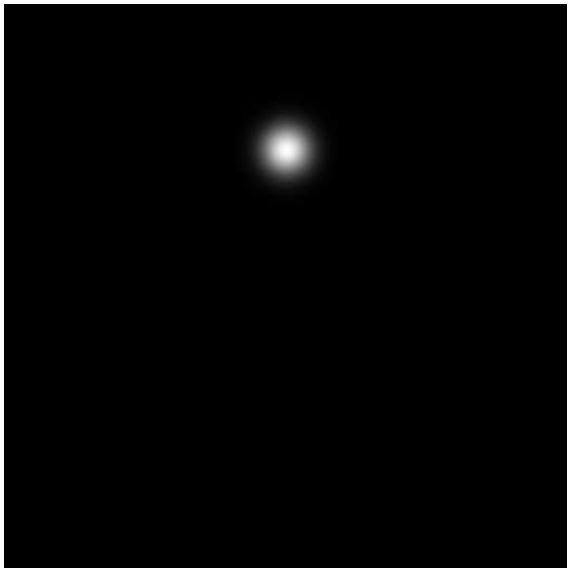
- ✓ Saccade accuracy
- ✓ Saccade latency
- ✓ **Saccade velocity**

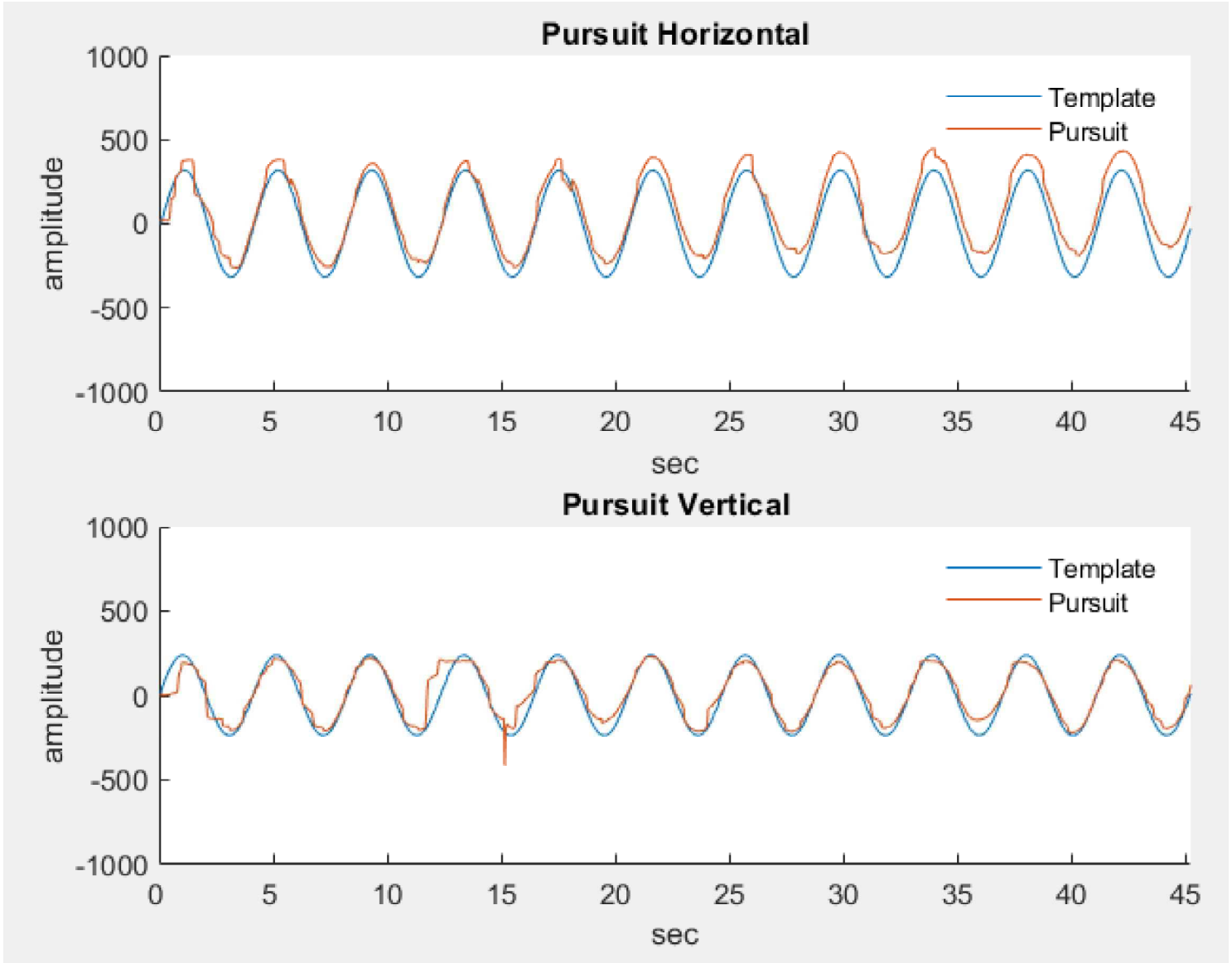


Jacobson, Gary P., et al. Jacobson GP, Shepard NT. Balance function assessment and management. San Diego: Plural (2008): 27-44.

Smooth pursuit tracking







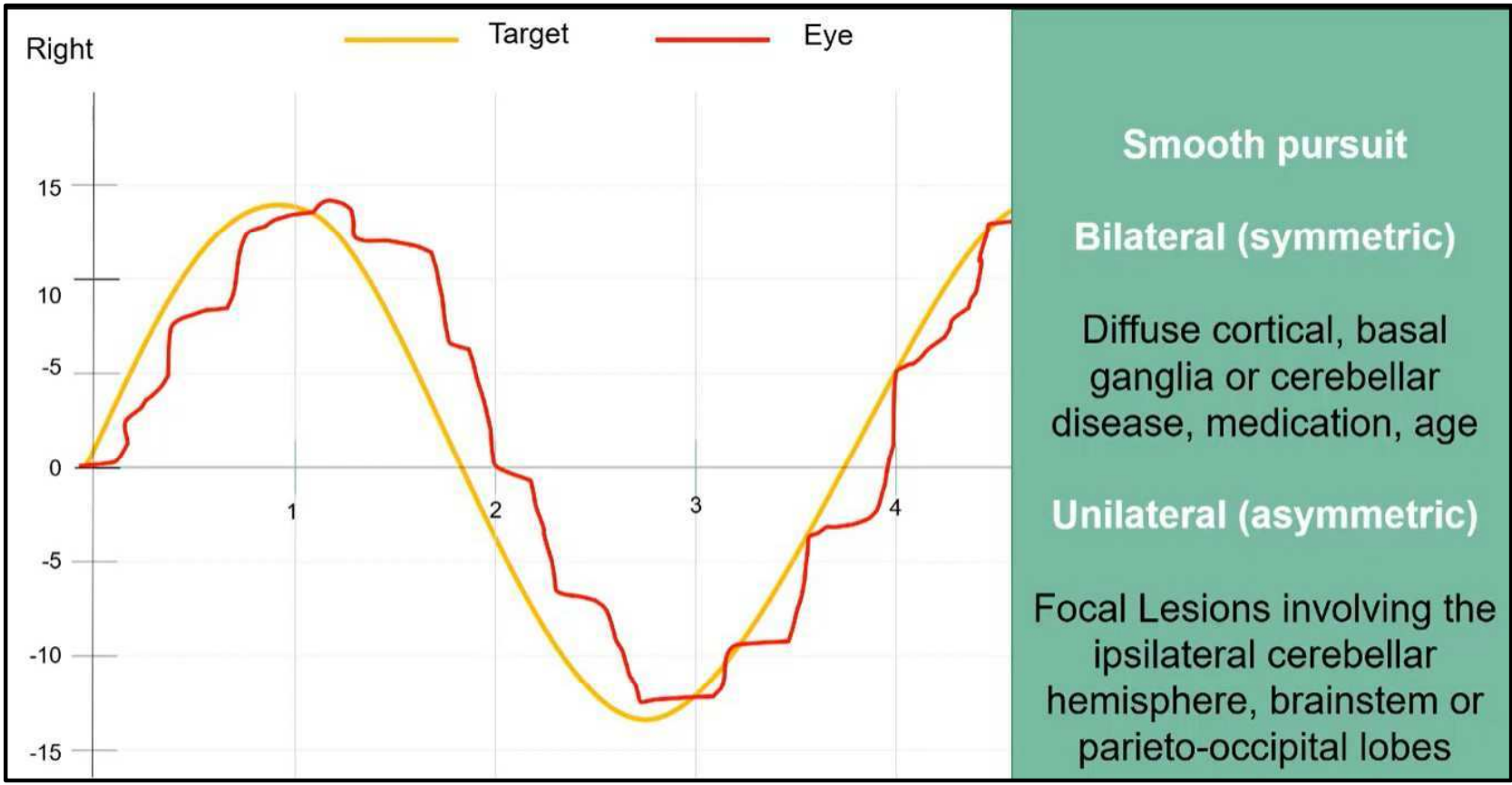
Jacobson, Gary P., et al. Jacobson GP, Shepard NT. Balance function assessment and management. San Diego: Plural (2008): 27-44.

Smooth pursuit tracking

Central lesion

✓ **Symmetry**

(Most sensitive to **central vestibular system** abnormality)

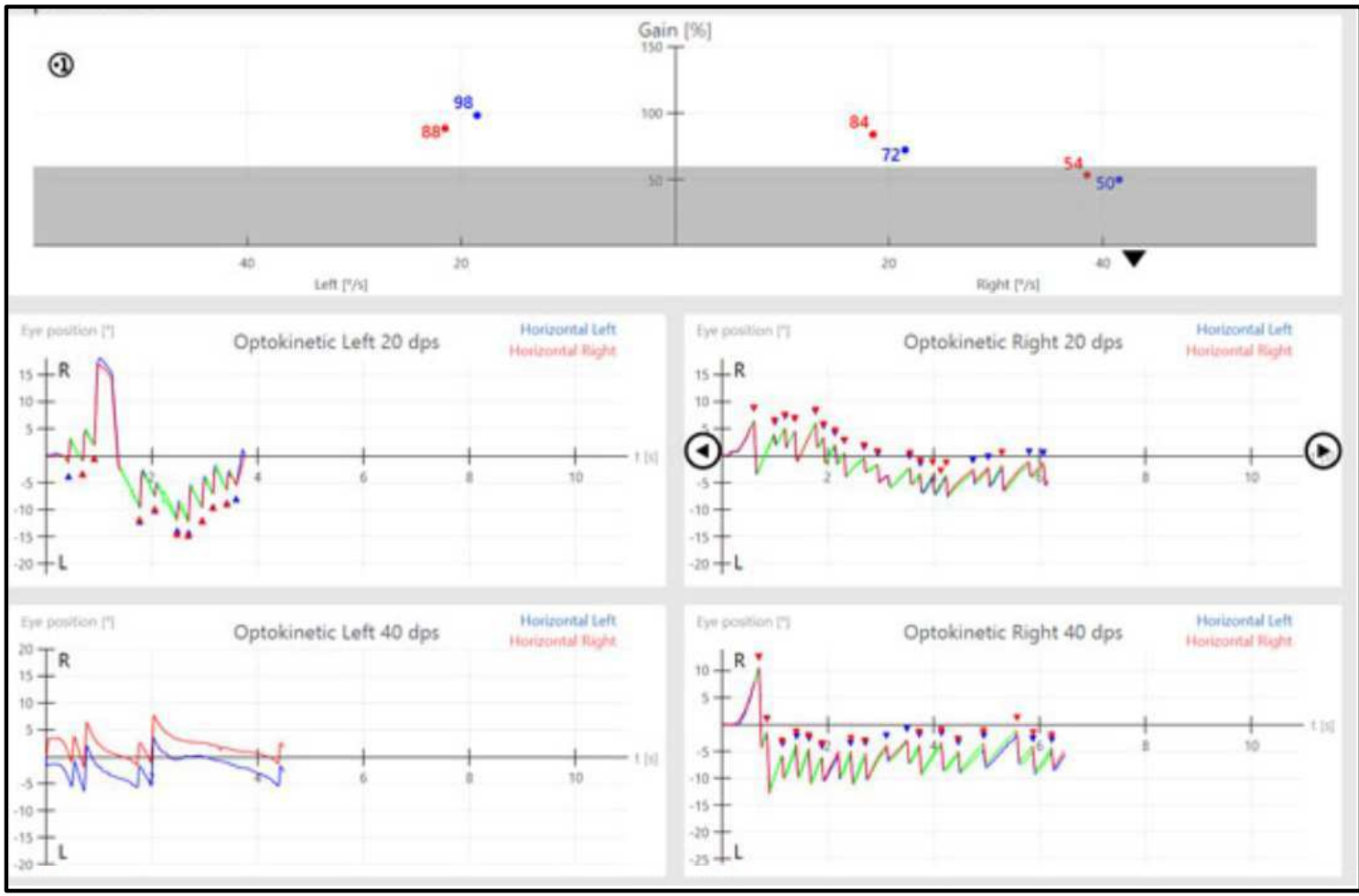


Jacobson, Gary P., et al. Jacobson GP, Shepard NT. Balance function assessment and management. San Diego: Plural (2008): 27-44.

Optokinetic test / OKAN

Central lesion (Brain stem and Cerebellum)

- ✓ **Symmetry**
- ✓ **Inversion**



Jacobson, Gary P., et al. *Jacobson GP, Shepard NT. Balance function assessment and management. San Diego: Plural* (2008): 27-44.

Oculomotor evaluation

Table III. Results of the study of visuo-oculomotor movements.

	MRI +	MRI -	Sens.	Spec.	+PF	-PF	Diagn. Acc.
+ Eye movement	35 (32.4%)	52 (48.1%)	83.3	21.2	40.2	66.6	45.3
- Eye movement	7 (6.4%)	14 (12.9%)					
+ Pursuit	30 (27.7%)	39 (36.1%)	71.4	40.9	43.4	69.2	52.7
- Pursuit	12 (11.1%)	27 (25.0%)					
+ Saccades	31 (28.7%)	44 (40.7%)	73.8	33.3	41.3	66.6	49.0
- Saccades	11 (10.1%)	22 (20.3%)					
Serious + alterations in eye movements	30 (27.7%)	33 (30.5%)	71.4	50.0	47.6	73.3	58.3
Serious – alterations in eye movements	12 (11.1%)	33 (30.5%)					

Sens.: sensitivity; Spec.: specificity; +PF: positive predictive factor; -PF: negative predictive factor; Diagn. acc.: diagnostic accuracy

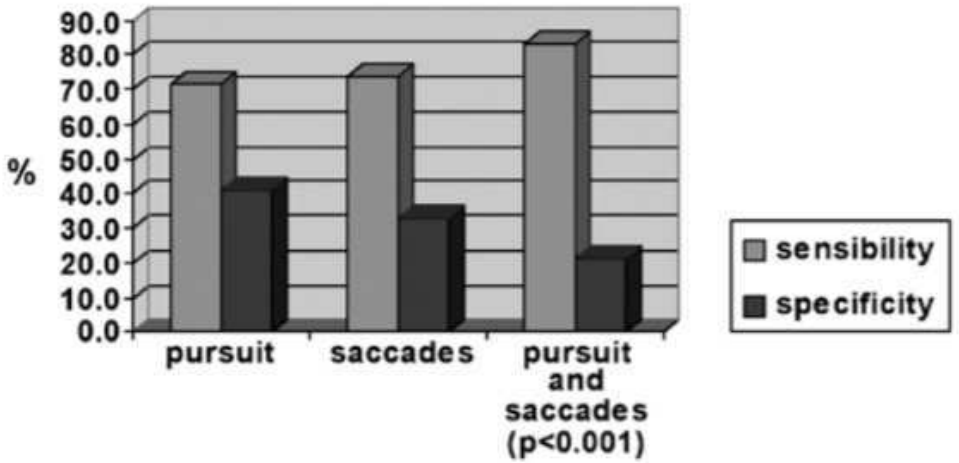


Fig. 2. Evaluation of sensitivity and specificity with saccades and smooth pursuit in conjunction compared to single methods.

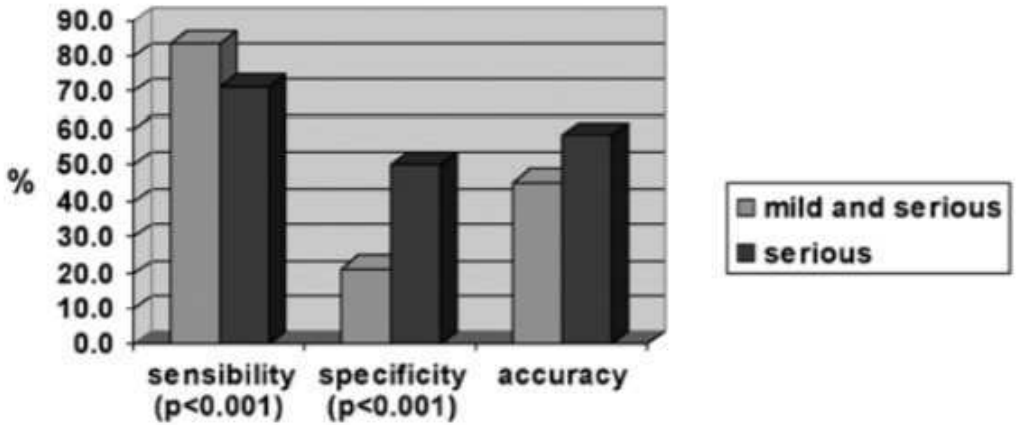


Fig. 3. Evaluation of sensitivity, specificity and accuracy of severe alterations in oculomotor movements compared to alterations taken as a whole (serious and mild).

Tirelli, G., et al. "Saccades and smooth pursuit eye movements in central vertigo." ACTA otorhinolaryngologica italica 31.2 (2011): 96.

Knowledge Gap and Aim

Single Rater

- Subjective interpretation
- Rater reliability

Multicollinearity

- Regression analysis

G Mankekar, et al. J Laryngol Otol. 2019;133(7):554-559.
Mohamed, E.S , et al. Egypt J Otolaryngol 2016;32,202–209

2013/09/01 – 2020/08/31 (n= 103)

Vertigo patients with Oculomotor tests and brain MRI

VNG ←→ Brain MRI: < 1 個月

Brain MRI (Gold Standard):

3位神經、影像科判讀

Table 1. Demographic and clinical characteristics of the 103 vertigo patients included in the study

Variables	All patients n=103	Central n=24	Nonspecific n=79	*p* value
Median age at diagnosis,				0.794
years (IQR)	60(49-69)	61(48-69)	60(49-69)	
Gender				*0.014
Female	65(63.1%)	10(41.7%)	55(69.6%)	
Male	38(36.9%)	14(58.3%)	24(30.4%)	
Body Mass Index (n=99)				0.339
Median (IQR)	24.0(21.7-25.7)	24.7(22.5-26.6)	23.8(21.7-25.7)	
Asymmetric hearing loss (n=85)				0.379
No	71(83.5%)	11(91.7%)	60(82.2%)	
Yes (> 30 dB loss)	14(16.5%)	1(8.3%)	13(17.8%)	
Neurologic symptoms				*<0.001
No	78(75.7%)	8(33.3%)	70(88.6%)	
Yes	25(24.3%)	16(66.7%)	9(11.4%)	
Central lesions (MRI)		N/A	N/A	
No	79(76.7%)			
Yes	24(23.3%)			
Lesion sites (MRI)		N/A	N/A	
Cortical and subcortical	10(38.5%)			
Brain stem	10(38.5%)			
Cerebellar	5(19.2%)			
Skull base	1(3.8%)			
Lesion types (MRI)		N/A	N/A	
Cerebrovascular accident	13(54.2%)			
Tumor	9(37.5%)			
Inflammation	2(8.3%)			

Sex

NE

Medical History

Table 1. Demographic and clinical characteristics of the 103 vertigo patients included in the study

Variables	All patients n=103	Central n=24	Nonspecific n=79	*p* value
Comorbidities				
Diabetes mellitus				0.556
No	83(80.6%)	18(75.0%)	65(82.3%)	
Yes	20(19.4%)	6(25.0%)	14(17.7%)	
Hypertension				0.323
No	52(50.5%)	10(41.7%)	42(53.2%)	
Yes	51(49.5%)	14(58.3%)	37(46.8%)	
Hyperlipidemia				0.253
No	66(64.1%)	13(54.2%)	53(67.1%)	
Yes	37(35.9%)	11(45.8%)	26(32.9%)	
History of CVA				0.622
No	97(94.2%)	22(91.7%)	75(94.9%)	
Yes	6(5.8%)	2(8.3%)	4(5.1%)	
Cardiovascular disease				0.588
No	98(95.2%)	24(100.0%)	74(93.7%)	
Yes	5(4.8%)	0(0.0%)	5(6.3%)	
Accumulated Comorbidities				0.709
0	28(27.2%)	5(20.8%)	23(29.1%)	
1-2	64(62.1%)	16(66.7%)	48(60.8%)	
≥ 3	11(10.7%)	3(12.5%)	8(10.1%)	

Abbreviations: CVA, cerebrovascular accident; IQR, interquartile range; N/A, not applicable

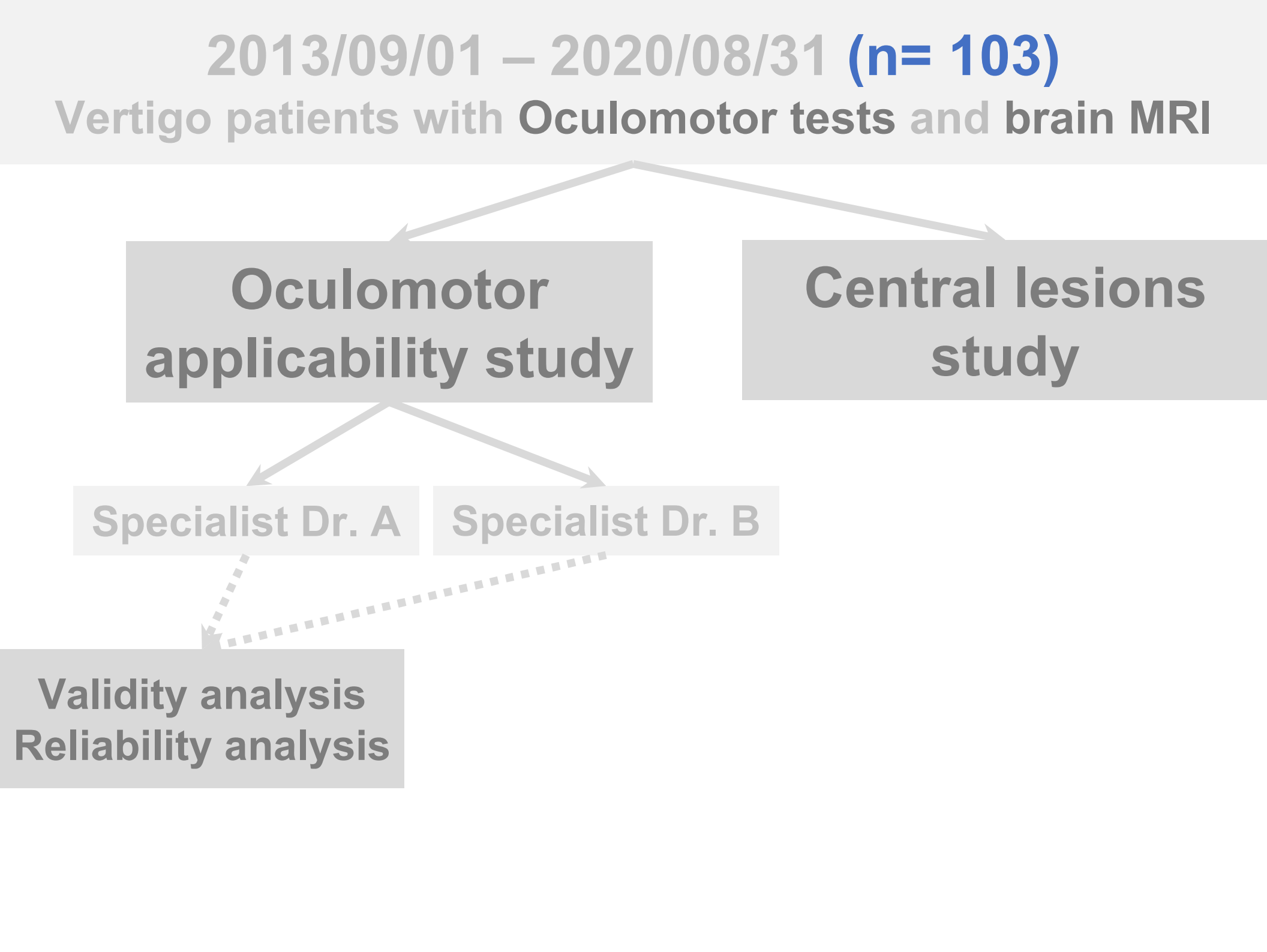
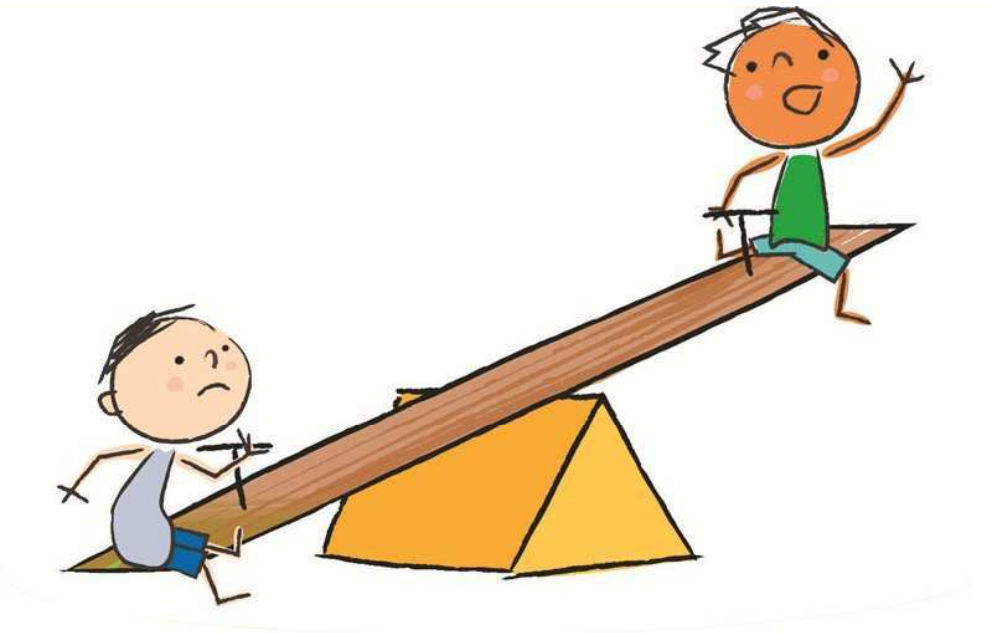

2013/09/01 – 2020/08/31 (n= 103)
Vertigo patients with Oculomotor tests and brain MRI
Oculomotor applicability study
Central lesions study
Specialist Dr. A
Specialist Dr. B
Validity analysis
Reliability analysis

Table 2. Validity and reliability of the oculomotor test interpretations of the two specialists

Moderate

Raters	Sensitivity	Specificity	PPV	NPV	Test-retest reliability Kappa (95% CI)	Inter-rater reliability Kappa (95% CI)
Dr. A	54.2%	67.1%	33.3%	82.8%	0.669 (0.521-0.817)	0.480 (0.329-0.630)
Dr. B	66.7%	43.0%	26.2%	81.0%	0.571 (0.413-0.729)	

Abbreviations: NPV, negative predictive value; PPV, positive predictive value



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Dr. A	54.2%	67.1%	33.3%	82.8%	0.669 (0.521-0.817)	0.480 (0.329-0.630)
Dr. B	66.7%	43.0%	26.2%	81.0%	0.571 (0.413-0.729)	

Abbreviations: NPV, negative predictive value; PPV, positive predictive value

RULE OUT central lesions

盛行率：24/103 = 23.3% ≈ 25%（文獻）

Venhovens, J, et al. J. Neurol. 2016, 263, 2151–2157.
Karatas, M, et al. Neurologist 2008, 14, 355–364.

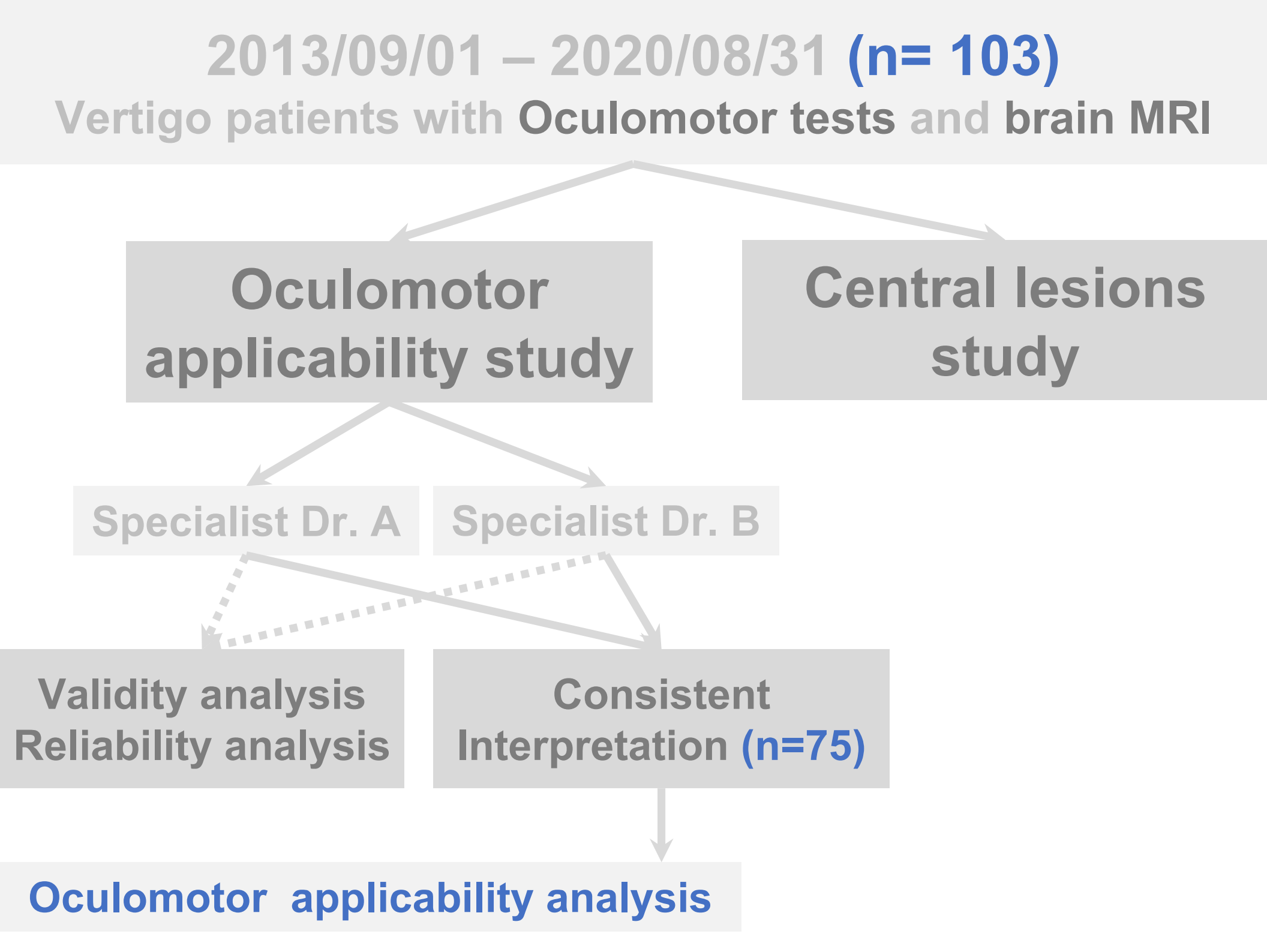

2013/09/01 – 2020/08/31 (n= 103)
Vertigo patients with Oculomotor tests and brain MRI
Oculomotor applicability study
Central lesions study
Specialist Dr. A
Specialist Dr. B
Validity analysis
Reliability analysis
Consistent Interpretation (n=75)
Oculomotor applicability analysis

Table 3. Demographic and clinical characteristics of patients whose oculomotor tests were consistent and inconsistent with the MRI findings (*n* = 75)

Variables	Consistent n = 44	Inconsistent n = 31	*p* value
Median age at diagnosis,			*<0.001
years (IQR)	55(41.5-63.5)	69(52-76)	
Gender			0.968
Female	30(68.2%)	21(67.7%)	
Male	14(31.8%)	10(32.3%)	
Body Mass Index			0.378
Median (IQR)	23.2(20.6-25.5)	24.0(21.8-25.9)	
Asymmetric hearing loss			0.804
No	33(86.8%)	24(88.9%)	
Yes (> 30 dB loss)	5(13.2%)	3(11.1%)	
Neurologic symptoms			0.640
No	36(81.4%)	24(77.4%)	
Yes	8(18.6%)	7(22.6%)	
Central lesions (MRI)			0.478
No	34(77.3%)	26(83.9%)	
Yes	10(22.7%)	5(16.1%)	
Lesion sites (MRI)			0.327
Cortical and subcortical	3(27.3%)	1(20.0%)	
Brain stem	6(54.6%)	1(20.0%)	
Cerebellar	2(18.1%)	3(60.0%)	
Lesion types (MRI)			0.213
Cerebrovascular accident	7(70.0%)	2(40.0%)	
Tumors	3(30.0%)	1(20.0%)	
Inflammation	0(0.0%)	2(40.0%)	

Age

N = 75

Table 3. Demographic and clinical characteristics of patients whose oculomotor tests were consistent and inconsistent with the MRI findings (*n* = 75)

Variables	Consistent n = 44	Inconsistent n = 31	*p* value
Comorbidities			
Diabetes mellitus			0.468
No	37(84.1%)	24(77.4%)	
Yes	7(15.9%)	7(22.6%)	
Hypertension			0.204
No	25(56.8%)	13(41.9%)	
Yes	19(43.2%)	18(58.1%)	
Hyperlipidemia			0.240
No	30(68.2%)	17(54.8%)	
Yes	14(31.8%)	14(45.2%)	
History of CVA			0.067
No	43(97.7%)	27(87.1%)	
Yes	1(2.3%)	4(12.9%)	
Cardiovascular disease			0.160
No	43(97.7%)	28(90.3%)	
Yes	1(2.3%)	3(9.7%)	
Accumulated Comorbidities			*0.017
0	15(34.1%)	3(9.7%)	
1-2	27(61.3%)	23(74.2%)	
≥ 3	2(4.6%)	5(16.1%)	

Abbreviations: CVA, cerebrovascular accident; IQR, interquartile range;

N = 75

Accumulated Comorbidities

Table 4. Univariate and multivariate analyses of factors predicting discordance between the interpretations of oculomotor tests and brain MRI (*n* = 75)

Variables	Univariate OR (95% CI)	*p* value	Multivariate OR (95% CI)	*p* value
Age				
< 60 years-old (n=34)	1		1	
≥ 60 years-old (n=41)	4.15(1.52-11.34)	*0.006	3.09(1.04-9.14)	*0.042
Gender				
Female	1		1	
Male	1.02(0.38-2.73)	0.968	0.91(0.30-2.83)	0.877
Body Mass Index (n=74)	1.05(0.94-1.17)	0.407		
Asymmetric hearing loss				
No (n=57)	1			
Yes (> 30 dB loss) (n=8)	0.83(0.18-3.79)	0.805		
Neurologic symptoms				
No	1		1	
Yes	1.31(0.42-4.10)	0.640	0.99(0.28-3.56)	0.991
Central lesions (MRI)				
No	1			
Yes	0.65(0.20-2.15)	0.484		

Age

N = 75

Table 4. Univariate and multivariate analyses of factors predicting discordance between the interpretations of oculomotor tests and brain MRI (*n* = 75)

Variables	Univariate OR (95% CI)	*p* value	Multivariate OR (95% CI)	*p* value
Comorbidities				
Diabetes mellitus				
No	1			
Yes	1.54(0.48-4.95)	0.467		
Hypertension				
No	1			
Yes	1.82(0.72-4.72)	0.206		
Hyperlipidemia				
No	1			
Yes	1.77(0.68-4.56)	0.241		
History of CVA				
No	1			
Yes	6.37(0.68-60.05)	0.106		
Cardiovascular disease				
No	1			
Yes	4.61(0.46-46.54)	0.195		
Accumulated Comorbidities				
0	1		1	
1-2	4.26(1.10-16.57)	*0.037	2.89(0.65-12.92)	0.164
≥ 3	12.50(1.60-97.64)	*0.016	8.31(0.96-71.71)	0.054

Abbreviations: CVA, cerebrovascular accident; OR, odds ratio

N = 75

Accumulated Comorbidities

Table S1. Validity analysis of oculomotor tests according to age and comorbidities in both raters.

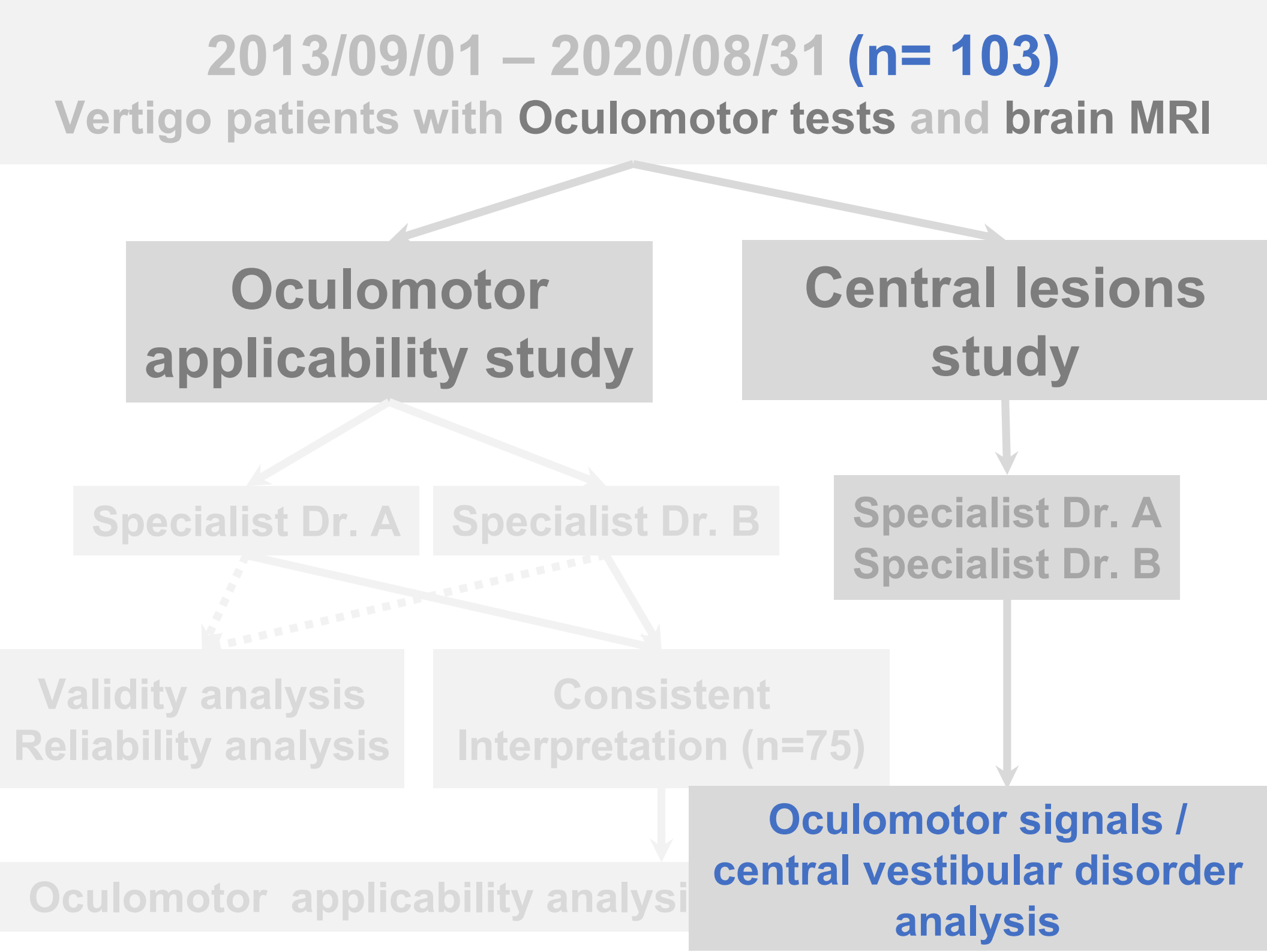
Raters	Sensitivity	Specificity	PPV
Dr. A			
< 60 years-old	60.0%	84.2%	50.0%
≥ 60 years-old	50.0%	51.2%	25.9%
Dr. B			
< 60 years-old	60.0%	57.9%	27.3%
≥ 60 years-old	71.4%	29.3%	25.6%

Age

Raters	Sensitivity	Specificity	PPV
Dr. A			
Comorbidities: 0	40.0%	100.0%	100.0%
Comorbidities: 1,2	62.5%	56.3%	32.3%
Comorbidities: ≥3	33.3%	37.5%	16.7%
Dr. B			
Comorbidities: 0	0.0%	65.2%	0.0%
Comorbidities: 1,2	87.5%	35.4%	31.1%
Comorbidities: ≥3	66.7%	25.0%	25.0%

Accumulated Comorbidities

Abbreviations: PPV, positive predictive value


2013/09/01 – 2020/08/31 (n= 103)
Vertigo patients with Oculomotor tests and brain MRI
Oculomotor applicability study
Central lesions study
Specialist Dr. A
Specialist Dr. B
Specialist Dr. A
Specialist Dr. B
Validity analysis
Reliability analysis
Consistent Interpretation (n=75)
Oculomotor applicability analysi
Oculomotor signals / central vestibular disorder analysis

N = 103

Table 5. Univariate analysis of oculomotor signals predicting abnormal brain MRI
The "factor score" was calculated via principal component analysis of significantly predictive tests (*n* = 103).

Oculomotor signals	Univariate OR (95% CI)	*p* value
Saccade		
Horizontal		
no	1	
yes	1.85(0.71-4.83)	0.206
Vertical		
no	1	
yes	3.58(1.29-9.98)	*0.015
Pursuit		
Horizontal		
no	1	
yes	3.39(1.26-9.09)	*0.016
Gaze		
Horizontal		
no	1	
yes	3.06(1.19-7.85)	*0.020
Vertical		
no	1	
yes	4.72(1.72-12.99)	*0.003
OPK		
no	1	
yes	1.22(0.44-3.36)	0.707
OKAN		
no	1	
yes	2.32(0.83-6.48)	0.108

Saccade V

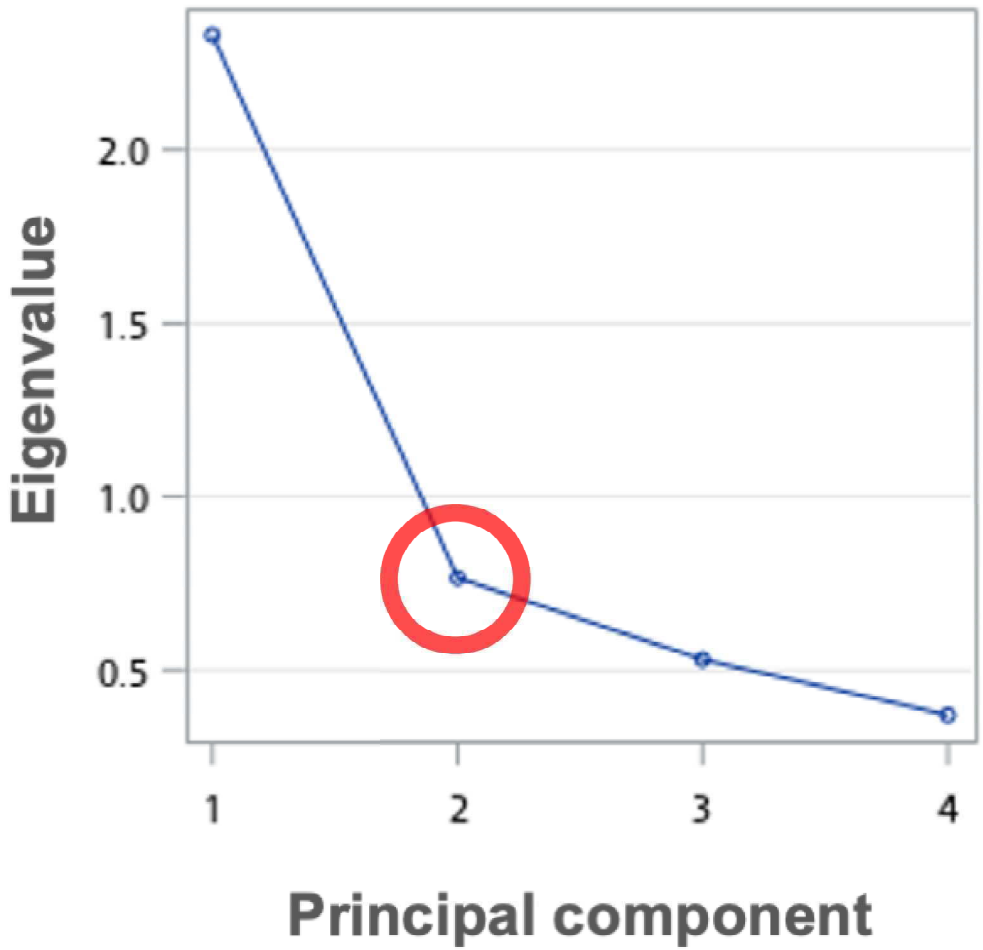
Pursuit H

Gaze H

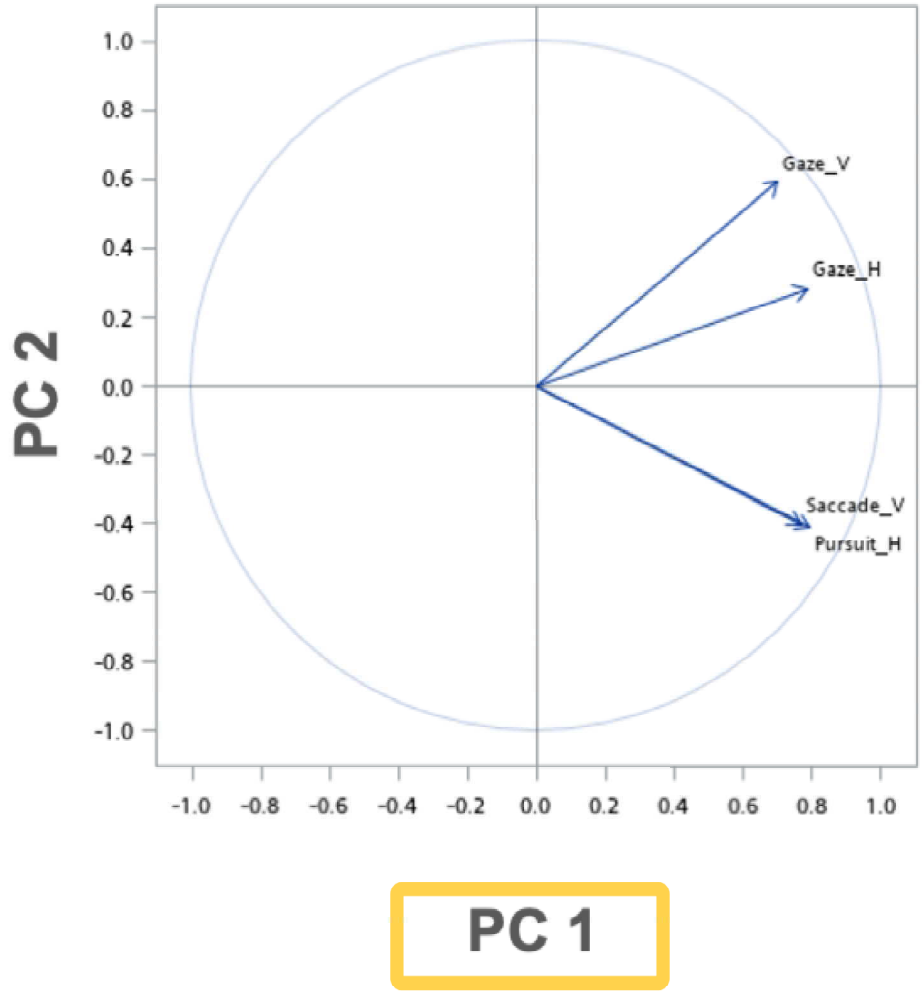
Gaze V

Principle Component Analysis

(A)



(B)



Oculomotor index =

0.505 Saccade_V + 0.519 Pursuit_H + 0.515 Gaze_H + 0.459 Gaze_V

N = 103

Table 6. Univariate and multivariate analyses of factors predicting abnormal brain MRI (*n* = 103)

Variables	Univariate OR (95% CI)	*p* value	Multivariate OR (95% CI)	*p* value
Age				
< 60 years-old (n=48)	1		1	
≥ 60 years-old (n=55)	1.30(0.52-3.27)	0.581	0.73(0.20-2.68)	0.632
Gender				
Female	1		1	
Male	3.21(1.25-8.23)	*0.015	2.85(0.82-9.90)	0.100
Body Mass Index (n=99)				
Median (IQR)	1.03(0.93-1.15)	0.528		
Asymmetric hearing loss (n=85)				
No	1			
Yes (> 30 dB loss)	0.42(0.05-3.54)	0.425		
Neurologic symptoms				
No	1		1	
Yes	15.56(5.20-46.56)	*<0.001	13.45(4.00-45.12)	*<0.001

NE

N = 103

Table 6. Univariate and multivariate analyses of factors predicting abnormal brain MRI (n = 103)

Variables	Univariate OR (95% CI)	*p* value	Multivariate OR (95% CI)	*p* value
Comorbidities				
Diabetes mellitus				
No	1			
Yes	1.55(0.52-4.60)	0.432		
Hypertension				
No	1			
Yes	1.59(0.63-4.00)	0.326		
Hyperlipidemia				
No	1			
Yes	1.73(0.68-4.37)	0.251		
History of CVA				
No	1			
Yes	1.71(0.29-9.94)	0.553		
Accumulated Comorbidities				
0	1		1	
1-2	1.53(0.50-4.70)	0.455	0.56(0.11-2.79)	0.481
≥ 3	1.73(0.33-8.91)	0.515	0.47(0.05-4.44)	0.506
Oculomotor index				
< 50%	1		1	
> 50%	4.65(1.66-12.99)	*0.003	4.59(1.28-16.44)	*0.019

Oculomotor Index

Discussion

Oculomotor applicability study

- ✓ Moderate reliability → Rater experience
- ✓ Elderly, comorbidities → Be careful
- ✓ High PPV → RULE OUT central lesions

Central lesions study

- ✓ PCA→ multivariate analysis
- ✓ Limitation: no detailed signal description

Jahn, K. Adv Otorhinolaryngol 82 (2019): 143-49.
Ringnér, M. Nat Biotechnol 26, no. 3 (2008): 303-4.

動眼檢查於中樞病灶的檢測

Oculomotor applicability study

- ✓ **Interpret carefully**

Central lesions study

- ✓ **Watch out central lesion**

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AI

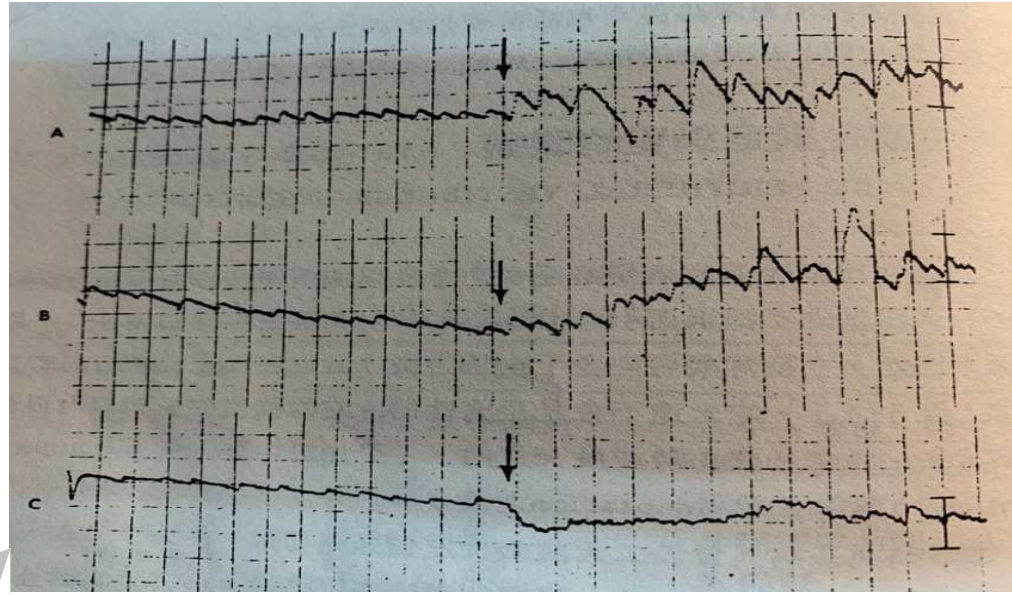
商業模式 → 醫療模式

眼振 +

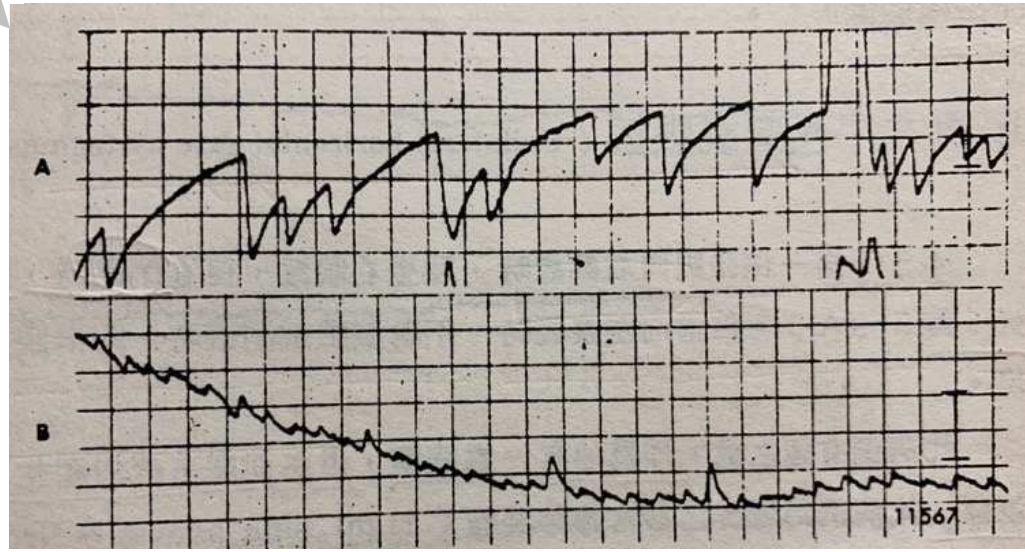
人工智慧自動判讀

1. 眩暈初篩工具
2. 健康管理

Frenzel goggles 眼鏡



周邊型眼振：單一方向、規律、閉眼時加強



中樞型眼振：方向不規律、震幅不規則、閉眼不加強

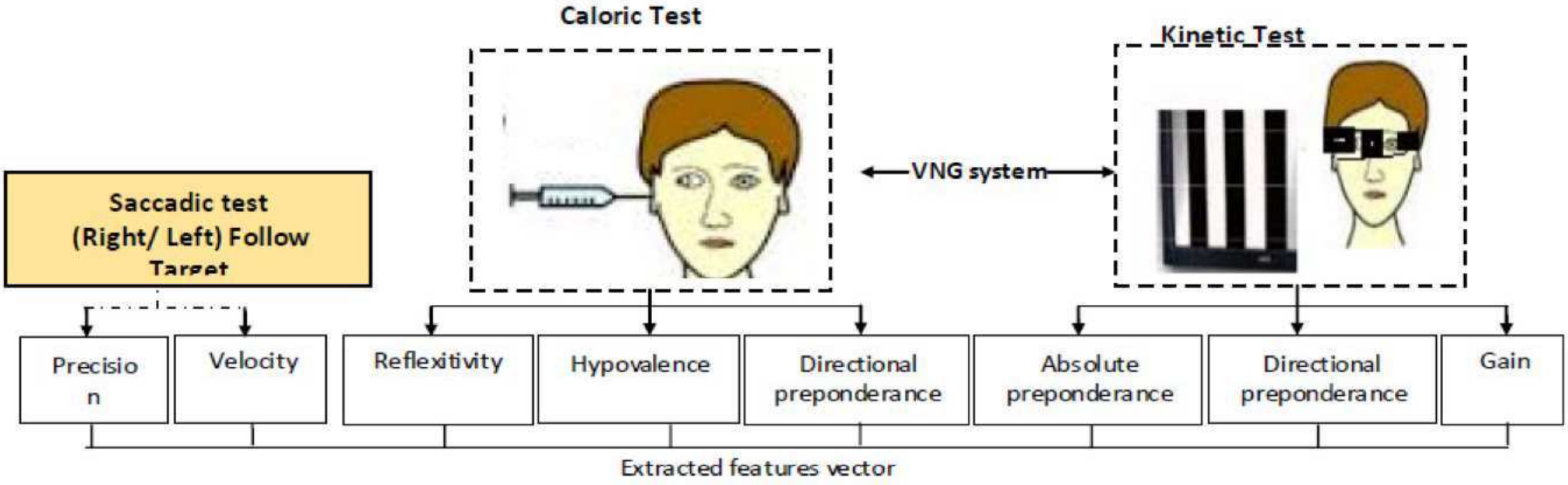
正常/
周邊型病灶

中樞型
病灶

別人怎麼做...

Peripheral Vestibular Disorder

Figure 1 Extracted parameters via the saccadic, kinetic and caloric VNG tests



我們的做法

Gaze –凝視 (水平/垂直)

Pursuit –追瞄 (水平/垂直)

Saccade –跳視 (水平/垂直)

六組訊號分析

我們的做法

簡單檢測方式

減少人為影響

未來商業化考量

六組訊號分析

訓練資料的驗證...

多數決（ex: 黃斑部病變）

大量資料的驗證

沒有客觀的黃金標準

黃金準則

客觀的驗證標準

資料量不足

訓練資料的驗證...

回溯資料標註 (約100筆)

VNG ←→ Brain MRI: < 1 個月

Brain MRI: 3位神經、影像科判讀

VNG: 2位耳鼻喉科專科醫師標註

模型的建立 (監督式學習)

第一分析模型

對比式學習訓練神經網絡模型

待分析中樞異常機率 (6組)

第二分析模型

隨機森林分類模型

綜合判讀是否為中樞病灶

驗證診斷模型 (16 正常/5 中樞)

	Dr. A	Dr. B	Model
Accuracy	61.9%	47.6%	76.2%
Sensitivity	60.0%	100%	80.0%
Specificity	62.5%	31.2%	75.0%
NPV	83.3%	100%	92.3%

驗證診斷模型 (31 正常/12 中樞)

	Dr. A	Dr. B	Model
Accuracy	61.9%	47.6%	69.8%
Sensitivity	60.0%	100%	83.3%
Specificity	62.5%	31.2%	64.5%
NPV	83.3%	100%	90.9%

正本

檔　　號：
保存年限：

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一、申請案號數：110106638

二、發明名稱：利用深度學習分析眼振感測資料的方法及眼振感測分析系統

三、申請人：

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To Be Continued…

資料量/資料性 (回溯分析劣勢)

- 提升量/效度 → Prospective study 收案驗證
- 近一步分析眼振的旋轉 → 周邊性眩暈的考量

未來性

- 與原廠洽談技術轉移
- 結合軟硬體(技術落地) →改變臨床路徑