

Title

Postoperative speech impairment and cranial nerve deficits in children undergoing posterior fossa tumor surgery with intraoperative MRI – a prospective multinational study

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Supplementary material

Supplementary Cross tables 1-4 postoperative cranial nerve deficit sum grouped and preoperative cranial nerve deficit sum

Supplementary Table 1 All patients

Preop. CND sum \ Postop. CND Group	Postop. CND Group				
	0	1	2	3 or more	Not available
0	405	50	30	33	62
1	24	29	15	3	9
2	7	3	14	10	1
3	1	0	1	4	0
4	2	0	0	2	1
5	0	0	0	2	0
6	2	0	0	0	0
9	0	0	0	0	1
12	0	0	0	0	1
Not available	29	7	5	5	32

CND Cranial nerve deficit

Supplementary Table 2 Subgroup intraoperative MRI = no

Preop. CND sum \ Postop. CND Group	Postop. CND Group				
	0	1	2	3 or more	Not available
0	259	42	19	20	37
1	11	21	12	3	7
2	5	3	8	6	0
3	1	0	1	4	0
4	2	0	0	0	1
12	1	0	0	0	0
Not available	0	0	0	0	1

CND Cranial nerve deficit

Supplementary Table 3 Subgroup Intraoperative MRI = yes

Postop. CND Group					
Preop. CND sum \	0	1	2	3 or more	Not available
0	79	6	8	5	14
1	6	5	0	0	1
2	2	0	0	1	1
Not available	4	1	1	1	6

CND Cranial nerve deficit

Supplementary Table 4 Subgroup Intraoperative MRI = Not available

Postop. CND Group					
Preop. CND sum \	0	1	2	3 or more	Not available
0	67	2	3	8	11
1	7	3	3	0	1
2	0	0	6	3	0
4	0	0	0	2	0
5	0	0	0	2	0
6	1	0	0	0	0
9	0	0	0	0	1
Not available	8	1	2	2	14

CND Cranial nerve deficit

Supplementary Table 5 Odds ratio results for POSI – sensitivity analysis with CND as a linear spline

Univariate analysis			Multivariate analysis			
Postoperative speech impairment			Model 1 (Intraoperative MRI and postoperative CND; n = 545)		Model 2 (Intraoperative MRI & postoperative CND & Tumour location; n = 525)	Model 3 (Intraoperative MRI & postoperative CND & Tumour location & age; n = 523)
Intraoperative MRI	OR (95% CI) (n = 602)	OR (95% CI) (Missing postop. CND removed) (n = 545)	OR (95% CI)	OR (95% CI) (Missing tumour location CND removed) (n = 525)	OR (95% CI)	OR (95% CI)
Yes	0.83 (0.53;1.30)	0.76 (0.46;1.27)	0.89 (0.53;1.50)	0.84 (0.49;1.46)	0.77 (0.44;1.34)	0.81 (0.45;1.43)
No	1 (ref)		1 (ref)		1 (ref)	1 (ref)
Postoperative CND (linear)	(n = 661)	(Missing ioMRI MR removed) (n = 545)				
0	1 (ref)		1 (ref)		1 (ref)	1 (ref)
1	2.91 (1.76;4.82)	2.84 (1.69;4.78)	2.81 (1.66;4.74)	2.85 (1.68;4.83)	1.91 (1.11;3.31)	1.87 (1.08;3.26)
2	2.37 (1.32;4.28)	2.41 (1.27;4.61)	2.40 (1.25;4.58)	2.75 (1.42;5.33)	2.04 (1.03;4.06)	2.09 (1.04;4.19)
3	2.05 (0.94;4.47)	1.92 (0.78;4.72)	1.92 (0.78;4.72)	2.35 (0.94;5.85)	1.81 (0.70;4.66)	1.85 (0.71;4.81)
>3	1.52 (1.21;1.92)	1.50 (1.16;1.94)	1.50 (1.15;1.94)	1.42 (1.09;1.84)	1.33 (1.02;1.73)	1.42 (1.09;1.86)

CI Confidence interval, *CND* Cranial nerve deficit, *MRI* Magnetic resonance imaging, *N* Number, *OR* Odds ratio, *POSI* Postoperative speech impairment

Supplementary Table 6 Odds ratio for risk of difference^a in CND pre- and postoperative including adjustment for missing values

Univariate analysis		Multivariate analysis		
Difference in post- and preoperative cranial nerve deficit		Model 1 (preoperative CND; n = 530)		Model 2 (preoperative CND & Tumour location; n = 513)
Intraoperative MRI	OR (95% CI) (n = 530)	OR (95% CI)	OR (95% CI) (Missing tumour location removed) (n = 513)	OR (95% CI)
Yes	0.72 (0.45;1.14)	0.62 (0.38;0.99)	0.57 (0.35;0.92)	0.51 (0.31;0.83) p = 0.007
No	1 (ref)	1 (ref)		1 (ref)

^aDifference group: Difference in sum of pre- and postoperative cranial nerve deficit. Cut off set to at -2 and 4, *CI* Confidence interval, *CND* Cranial nerve deficit, *MRI* Magnetic resonance imaging, *N* Number, *OR* Odds ratio, *Ref* Reference

Supplementary Table 7 Odds ratio results for postoperative CND and ioMRI including adjustment for missing values

Univariate analysis			Multivariate analysis			
Postoperative cranial nerve deficit			Model 1 (Preoperative CND, n = 530)		Model 2 (Preoperative CND & Intraoperative MRI & Tumour location; n = 328)	Model 3 (Preoperative CND & Intraoperative MRI & Tumour location & Country; n = 328)
Intraoperative MRI	OR (95% CI) (n = 563)	OR (95% CI) (Missing preoperative CND removed) (n = 530)	OR (95% CI)	OR (95% CI) (Missing tumour location removed) (n = 513)	OR (95% CI)	OR (95% CI)
Yes	0.63 (0.40;1.00)	0.59 (0.36;0.96)	0.67 (0.41;1.09)	0.61 (0.37;1.02)	0.58 (0.33;0.94) p=0.03	0.54 (0.29;0.98)
No	1 (ref)		1 (ref)	1 (ref)		1(ref)

CI Confidence interval, CND Cranial nerve deficit, ioMRI Intraoperative magnetic resonance imaging, N Number, OR Odds ratio, Ref Reference

Supplementary Table 8 Odds ratio results for risk of postoperative CND for countries utilizing ioMRI

Univariate analysis		Multivariate analysis	
Postoperative cranial nerve deficit		Model 1 (Preoperative CND, n = 394)	Model 2 (Preoperative CND & Tumour location; n = 383)
Intraoperative MRI	OR (95% CI) (n = 422)	OR (95% CI)	OR (95% CI)
Yes	0.67 (0.41;1.08)	0.67 (0.40;1.11)	0.52 (0.30;0.91) p=0.02
No	1 (ref)	1 (ref)	1 (ref)

CI Confidence interval, CND Cranial nerve deficit, ioMRI Intraoperative magnetic resonance imaging, N Number, OR Odds ratio, Ref Reference

Supplementary Table 9 Odds ratio results for POSI

Univariate analysis			Multivariate analysis					
Postoperative speech impairment			Model 1 (Intraoperative MRI and postoperative CND; n = 545)		Model 2 (Intraoperative MRI & postoperative CND & Tumour location; n = 525)	Model 3 (Intraoperative MRI & postoperative CND & Tumour location & age; n = 523)	Model 4 (Intraoperative MRI & postoperative CND & Tumour location & age & country; n = 523)	Model 5 (Intraoperative MRI & postoperative CND & tumour location & tumour type ^a ; n = 481)
Intraoperative MRI	OR (95% CI) (n = 602)	OR (95% CI) (Missing postop. CND removed) (n = 545)	OR (95% CI)	OR (95% CI) (Missing tumour location CND removed) (n = 525)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Yes	0.83 (0.53;1.30)	0.76 (0.46;1.27)	0.85 (0.50;1.45)	0.80 (0.46;1.38)	0.73 (0.42;1.29)	0.76 (0.43;1.35)	0.76 (0.43;1.36)	0.80 (0.43;1.46)
No	1 (ref)		1 (ref)		1 (ref)	1 (ref)	1 (ref)	1 (ref)
Postoperative CND	OR (95% CI) (n = 661)	OR (95% CI) (Missing ioMRI MR removed)						
0	1 (ref)		1 (ref)		1 (ref)	1 (ref)	1 (ref)	1 (ref)
1	2.90 (1.75;4.78)	2.82 (1.68;4.76)	2.78 (1.65;4.70)	2.83 (1.67;4.78)	1.89 (1.09;3.27)	1.84 (1.06;3.20)	1.84 (1.06;3.20)	2.06 (1.15;3.68)
2	2.36 (1.31;4.26)	2.41 (1.26;4.59)	2.38 (1.23;4.55)	2.73 (1.41;5.28)	2.41 (1.09;5.33)	2.06 (1.03;4.13)	2.06 (1.03;4.13)	2.13 (1.02;4.42)
3 or more	5.39 (3.09;9.42)	4.77 (2.50;9.07)	4.72 (2.48;9.00)	5.16 (2.65;10.05)	3.53 (1.77;7.03)	4.13 (2.04;8.35)	4.13 (2.04;8.35)	4.15 (1.98;8.70)

^aPilocytic astrocytoma (reference), medulloblastoma, ependymoma, atypical teratoid/rhabdoid tumour, and other

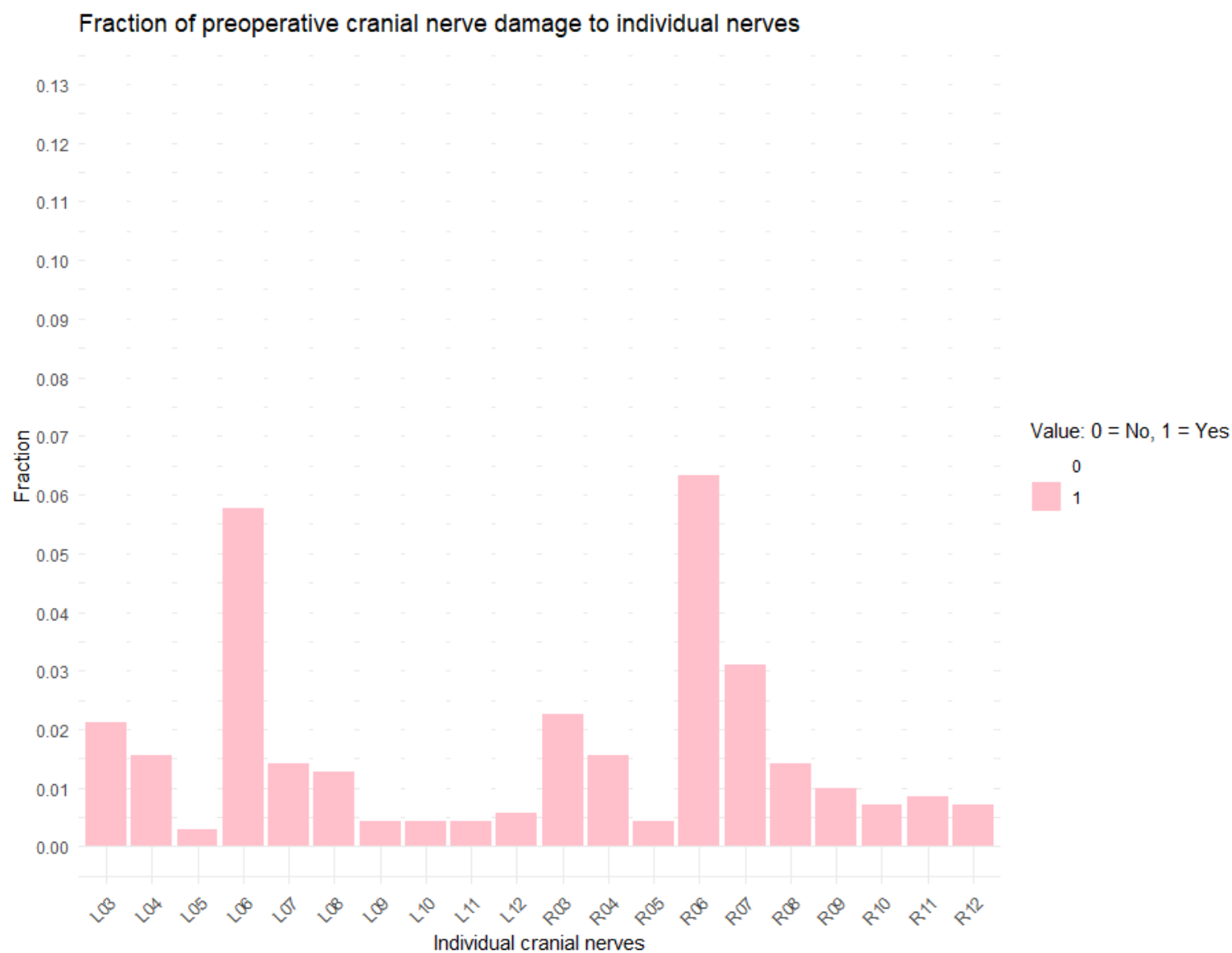
CI Confidence interval, CND Cranial nerve deficit, ioMRI Intraoperative magnetic resonance imaging, N Number, OR Odds ratio, Ref Reference, POSI Postoperative speech impairment

Supplementary Table 10 Odds ratio results for POSI (countries utilizing ioMRI)

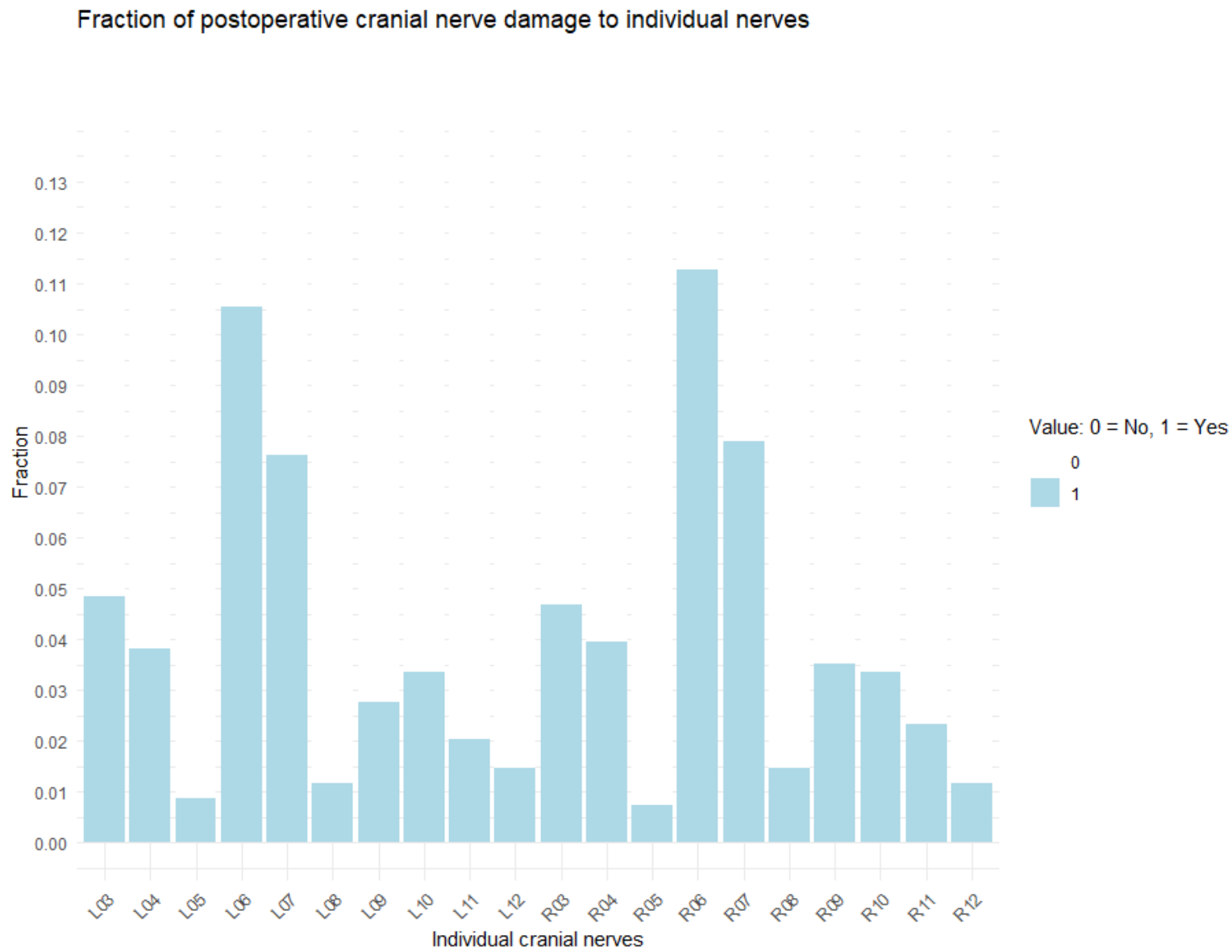
Univariate analysis		Multivariate analysis		
Postoperative speech impairment		Model 1 (postoperative CND; n = 410)	Model 2 (Postoperative CND & Tumour location; n = 397)	Model 3 (Postoperative CND & Tumour location & age; n = 395)
Intraoperative MRI	OR (95% CI) (n = 458)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Yes	0.90 (0.56;1.44)	0.93 (0.53;1.62)	0.75 (0.41;1.36)	0.77 (0.42;1.41)
No	1 (ref)	1 (ref)	1 (ref)	1 (ref)

CI Confidence interval, *ioMRI* Intraoperative magnetic resonance imaging, *N* Number, *OR* Odds ratio, *Ref* Reference, *POSI* Postoperative speech impairment

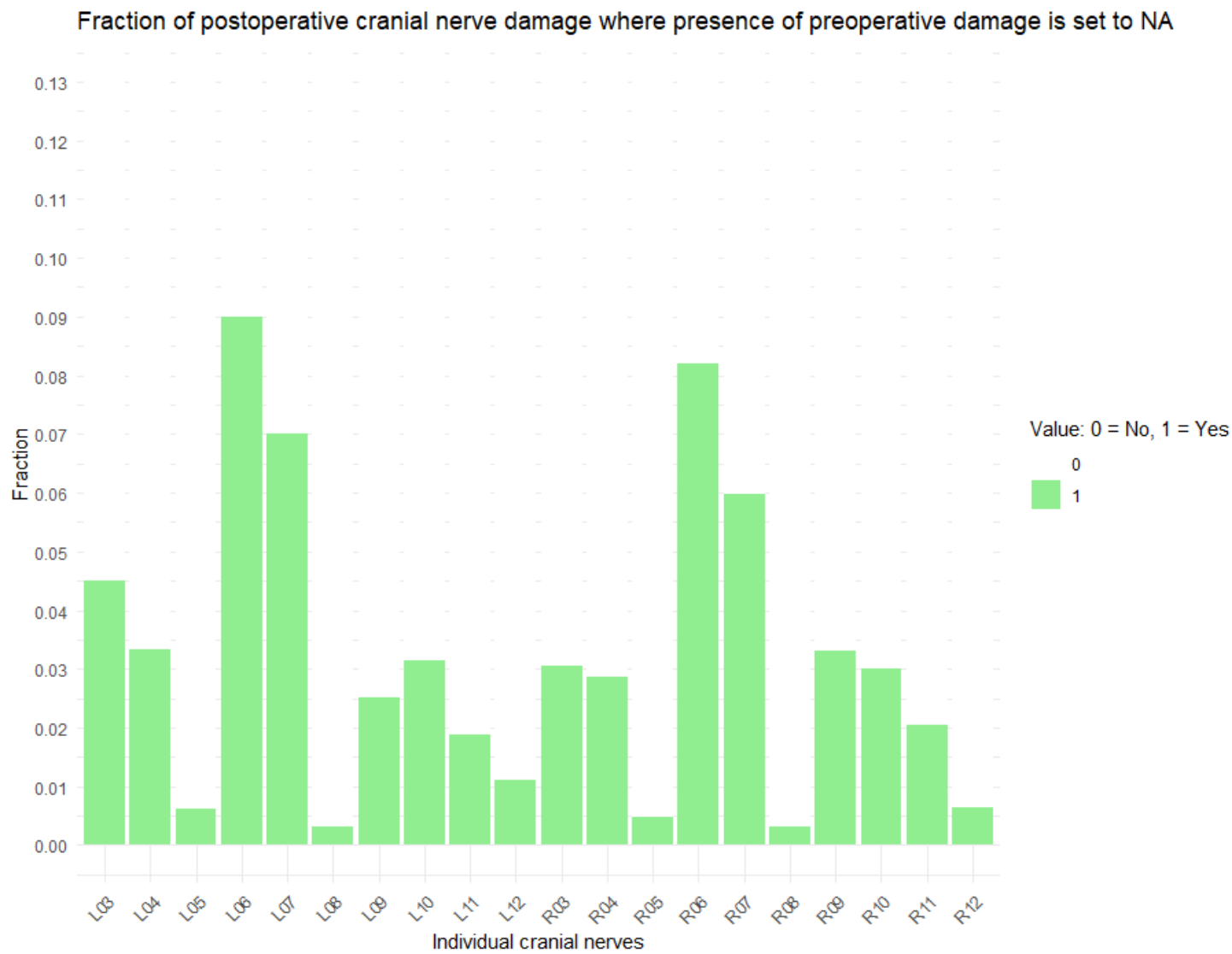
Supplementary Figure 1 Barchart representing fraction of preoperative damage to individual cranial nerves; *L* Left, *R* Right



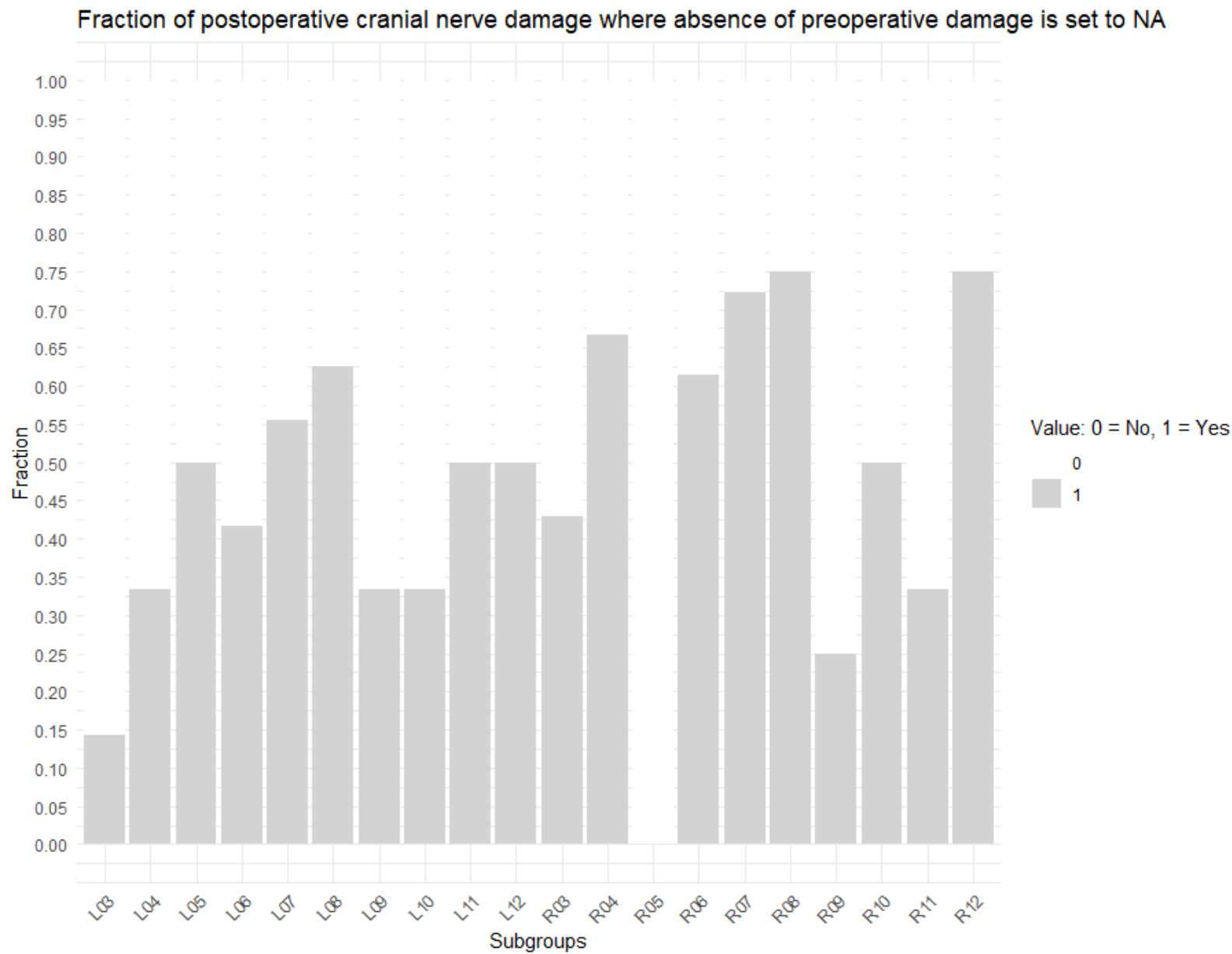
Supplementary Figure 2 Barchart representing fraction of postoperative damage to individual cranial nerves; *L* Left, *R* Right



Supplementary Figure 3 Barchart of fraction of postoperative individual cranial nerve damage where presence of preoperative individual cranial nerve damage is set to “Not assessable”; *L* Left, *R* Right



Supplementary Figure 4 Barchart of fraction of postoperative cranial nerve damage where absence of preoperative individual cranial nerve damage is set “Not assessable”; *L* Left, *R* Right



Supplementary Table 11 Demographics	All patients (n = 790)			Known status of Intraoperative MRI (n = 643)		Intraoperative MRI applied (n = 141)	
	N	% ^c	% ^d	N	% ^e	N	% ^f
Preoperative accumulated CND^a							
0	580	73.4	81.5	489	84	112	23
1	80	10.1	11.2	66	83	12	18
2	35	4.4	4.9	26	74	4	15
3	6	0.8	0.8	6	100	0	0
4	5	0.6	0.7	3	60	0	0
5	2	0.3	0.3	1	50	0	0
6	2	0.3	0.3	0	0	0	-
9	1	0.1	0.1	0	0	0	-
12	1	0.1	0.1	1	100	0	0
Unknown	78	9.9		51	65	13	26
Postoperative accumulated CND^b							
0	470	59.5	68.8	387	82	91	24
1	89	11.3	13.0	83	93	12	14
2	65	8.2	9.5	51	78	9	18
3	22	2.8	3.2	16	73	4	25
4	9	1.1	1.3	8	89	1	13
5	6	0.8	0.9	4	67	0	0
6	8	1.0	1.2	5	63	1	20
7	3	0.4	0.4	1	33	0	0
8	4	0.5	0.6	4	100	1	25
10	4	0.5	0.6	3	75	0	0
12	1	0.1	0.1	1	100	0	0
13	1	0.1	0.1	0	0	0	-
18	1	0.1	0.1	0	0	0	-
Unknown	107	13.5		80	75	22	28

^aAccumulated damaged CN's preoperatively, ^bAccumulated damaged CN's postoperatively, ^call patients eligible for analysis (*vertical*), ^d% among patients with known CND status, ^e% of patient characteristics or tumour characteristics (*horisontal*), ^f% of subgroup with known status of intraoperative MRI (*horisontal*)
CND Cranial nerve deficit, MRI Magnetic resonance imaging, N Number

Supplementary Table 12 Demographics	Habitual speech (n = 551)		Reduced speech (n = 98)		Mutism (n = 85)	
	N	% ^a	N	% ^b	N	% ^b
Postoperative CND						
0	383	52	50	11	24	5
1	54	7	17	20	13	15
2	45	6	8	13	11	17
3 or more	28	4	13	23	15	27
Unknown	41	5 ^c	10	14	22	30

^a% of known speech status, ^b% in CND category, ^c% of total cohort (n = 790)
CND Cranial nerve deficit, N Number