|  |
| --- |
| **Supporting Table S1.** Inter-rater reliability of nvUS in 5 randomly chosen subjects |
|  |  |  |  |
|  | ICC | 95% CI | p-value |
| PSV | 0.785 | 0.622-0.878 | <0.001 |
| EDV | 0.876 | 0.782-0.930 | <0.001 |
| Mean | 0.813 | 0.670-0.894 | <0.001 |
| Flow volume | 0.802 | 0.651-0.888 | <0.001 |
|  |  |  |  |
| ICC: intraclass correlation coefficient; CI: confidence interval; PSV: Peak-systolic velocity; EDV: end-diastolic velocity  |
|  |  |  |  |

|  |
| --- |
| **Supporting Table S2**: Flow velocities (cm s−1) and flow volume (ml/min) measurements of all locations using neurovascular ultrasound and real-time phase-contrast flow MRI |
|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|  | s1 right  | s1 left | s2 right | s2 left | s3 right |
|  | nvUS | RT-PC flow MRI | nvUS | RT-PC flow MRI | nvUS | RT-PC flow MRI | nvUS | RT-PC flow MRI | nvUS | RT-PC flow MRI |
|   | PSV | EDV | FV  | PSV | EDV | FV | PSV | EDV | FV  | PSV | EDV | FV | PSV | EDV | FV  | PSV | EDV | FV | PSV | EDV | FV  | PSV | EDV | FV | PSV | EDV | FV | PSV | EDV | FV |
| 1 | 104.8 | 29.5 | 430.0 | 64.1 | 22.5 | 440.0 | 129.0 | 33.7 | 330.0 | 63.1 | 20.7 | 400.0 | 90.8 | 31.8 | 440.0 | 69.4 | 24.0 | 450.0 | 101.3 | 30.0 | 430.0 | 75.5 | 26.8 | 480.0 | 81.2 | 29.4 | 240.0 | 36.6 | 15.7 | 220.0 |
| 2 | 70.0 | 17.9 | 285.0 | 68.2 | 23.0 | 300.0 | 70.5 | 18.6 | 233.0 | 71.4 | 20.5 | 280.0 | 102.8 | 34.8 | 548.0 | 64.7 | 23.4 | 340.0 | 82.5 | 27.5 | 327.0 | 70.9 | 21.7 | 320.0 | 83.5 | 33.5 | 265.0 | 53.5 | 22.6 | 220.0 |
| 3 | 86.1 | 23.0 | 305.0 | 53.8 | 17.6 | 380.0 | 86.9 | 25.7 | 246.0 | 52.6 | 17.7 | 360.0 | 75.3 | 26.6 | 222.0 | 60.0 | 21.9 | 440.0 | 82.4 | 28.1 | 366.0 | 62.4 | 25.1 | 480.0 | 81.6 | 31.3 | 109.0 | 40.5 | 22.0 | 360.0 |
| 4 | 126.1 | 14.4 | 414.0 | 97.8 | 24.1 | 430.0 | 123.3 | 19.7 | 398.0 | 94.3 | 24.5 | 510.0 | 98.6 | 19.3 | 357.0 | 84.5 | 19.3 | 380.0 | 95.0 | 16.8 | 250.0 | 87.6 | 35.2 | 470.0 | 82.4 | 23.0 | 187.0 | 41.6 | 14.0 | 200.0 |
| 5 | 143.9 | 27.4 | 518.0 | 78.3 | 21.3 | 400.0 | 100.7 | 25.8 | 255.0 | 82.8 | 21.8 | 410.0 | 126.1 | 25.1 | 512.0 | 85.9 | 22.5 | 450.0 | 88.8 | 19.6 | 299.0 | 82.7 | 23.0 | 450.0 | 64.6 | 24.1 | 126.0 | 51.4 | 19.5 | 270.0 |
| 6 | 127.3 | 33.4 | 401.0 | 59.0 | 15.8 | 360.0 | 136.2 | 30.8 | 343.0 | 75.4 | 21.2 | 370.0 | 117.0 | 31.1 | 360.0 | 77.1 | 19.2 | 390.0 | 112.6 | 29.2 | 326.0 | 93.7 | 26.4 | 460.0 | 107.8 | 46.3 | 225.0 | 68.3 | 28.3 | 350.0 |
| 7 | 105.7 | 23.9 | 369.0 | 58.8 | 15.9 | 370.0 | 136.5 | 33.8 | 389.0 | 63.1 | 23.2 | 420.0 | 108.3 | 23.9 | 269.0 | 65.7 | 19.3 | 390.0 | 106.1 | 26.8 | 397.0 | 83.7 | 26.3 | 490.0 | 89.8 | 33.0 | 175.0 | 53.7 | 24.1 | 300.0 |
| 8 | 113.6 | 23.7 | 209.0 | 85.3 | 17.5 | 290.0 | 176.0 | 30.7 | 339.0 | 71.4 | 27.6 | 430.0 | 111.1 | 26.2 | 219.0 | 77.9 | 14.9 | 310.0 | 131.0 | 30.7 | 355.0 | 85.2 | 24.3 | 420.0 | 62.6 | 22.3 | 161.0 | 41.5 | 13.6 | 240.0 |
| 9 | 113.6 | 21.5 | 457.0 | 116.1 | 29.3 | 590.0 | 124.6 | 27.5 | 411.0 | 52.6 | 32.6 | 610.0 | 103.6 | 23.7 | 499.0 | 101.1 | 24.7 | 570.0 | 110.4 | 24.4 | 355.0 | 111.6 | 34.5 | 560.0 | 88.4 | 26.2 | 298.0 | 47.0 | 18.9 | 380.0 |
| 10 | 96.1 | 29.5 | 377.0 | 72.8 | 25.1 | 520.0 | 132.0 | 26.5 | 263.0 | 94.3 | 26.6 | 420.0 | 106.4 | 32.0 | 403.0 | 72.0 | 27.9 | 540.0 | 115.6 | 29.2 | 268.0 | 83.3 | 25.7 | 440.0 | 96.1 | 34.6 | 279.0 | 63.0 | 26.8 | 380.0 |
| 11 | 121.5 | 24.3 | 294.0 | 62.3 | 11.7 | 230.0 | 140.7 | 26.5 | 431.0 | 82.8 | 23.2 | 550.0 | 107.6 | 24.3 | 386.0 | 107.3 | 20.2 | 410.0 | 135.1 | 29.2 | 466.0 | 105.7 | 25.3 | 610.0 | 97.7 | 24.7 | 206.0 | 52.9 | 16.8 | 250.0 |
| 12 | 93.5 | 29.3 | 243.0 | 61.8 | 18.4 | 350.0 | 100.0 | 28.7 | 247.0 | 75.4 | 18.6 | 360.0 | 132.5 | 34.9 | 449.0 | 88.3 | 22.3 | 440.0 | 98.1 | 30.7 | 367.0 | 94.2 | 30.7 | 500.0 | 107.5 | 34.9 | 211.2 | 64.8 | 25.9 | 350.0 |
| 13 | 96.1 | 18.1 | 262.0 | 47.3 | 12.2 | 290.0 | 122.5 | 22.2 | 270.0 | 64.5 | 17.7 | 330.0 | 107.2 | 23.7 | 394.0 | 56.1 | 16.0 | 340.0 | 122.0 | 31.4 | 409.0 | 87.3 | 27.4 | 460.0 | 80.1 | 31.4 | 224.0 | 39.7 | 17.6 | 290.0 |
| 14 | 130.4 | 37.1 | 393.0 | 90.5 | 23.7 | 440.0 | 143.9 | 27.4 | 336.0 | 100.7 | 29.6 | 500.0 | 146.7 | 41.8 | 532.0 | 97.8 | 26.8 | 480.0 | 149.1 | 39.4 | 310.0 | 111.9 | 32.9 | 520.0 | 115.9 | 43.9 | 196.0 | 50.2 | 19.8 | 280.0 |
| 15 | 88.0 | 20.9 | 262.0 | 90.5 | 24.0 | 440.0 | 100.9 | 26.8 | 304.0 | 93.1 | 19.6 | 380.0 | 82.6 | 20.9 | 216.0 | 87.2 | 19.7 | 410.0 | 87.5 | 22.2 | 292.0 | 80.0 | 21.1 | 390.0 | 68.0 | 19.5 | 156.0 | 47.6 | 19.6 | 270.0 |
| 16 | 119.2 | 24.4 | 503.0 | 68.3 | 15.7 | 410.0 | 123.3 | 22.7 | 277.0 | 80.2 | 17.4 | 420.0 | 91.0 | 26.9 | 420.0 | 71.1 | 18.0 | 520.0 | 101.6 | 22.7 | 270.0 | 85.1 | 17.4 | 460.0 | 69.0 | 27.5 | 221.0 | 39.0 | 18.1 | 280.0 |
| 17 | 119.2 | 24.4 | 365.0 | 61.4 | 17.8 | 410.0 | 112.7 | 24.4 | 335.0 | 68.4 | 17.3 | 330.0 | 109.0 | 21.8 | 355.0 | 58.9 | 16.0 | 340.0 | 112.7 | 22.1 | 341.0 | 107.3 | 25.0 | 580.0 | 67.7 | 21.9 | 132.0 | 54.6 | 18.8 | 250.0 |
| 18 | 123.3 | 31.7 | 235.0 | 76.1 | 27.1 | 410.0 | 115.9 | 20.9 | 263.0 | 96.9 | 29.9 | 500.0 | 99.5 | 31.6 | 263.0 | n/a | n/a | n/a | 108.5 | 24.5 | 292.0 | 85.5 | 31.8 | 560.0 | 67.8 | 28.3 | 159.0 | n/a | n/a | n/a |
| 19 | 127.1 | 29.8 | 476.0 | 95.4 | 24.8 | 460.0 | 126.0 | 26.9 | 446.0 | 111.7 | 31.2 | 630.0 | 100.6 | 23.2 | 278.0 | 96.3 | 24.9 | 500.0 | 106.6 | 26.9 | 311.0 | 104.1 | 29.6 | 620.0 | 89.5 | 38.7 | 292.0 | 50.7 | 21.7 | 340.0 |
| 20 | 112.9 | 29.0 | 403.0 | 98.1 | 24.6 | 430.0 | 99.9 | 24.7 | 306.0 | 96.5 | 25.2 | 430.0 | 108.9 | 31.6 | 307.0 | 93.3 | 23.5 | 460.0 | 115.0 | 31.2 | 247.0 | 97.7 | 23.9 | 440.0 | 97.2 | 33.9 | 201.0 | 57.9 | 17.5 | 270.0 |
|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | s3 left  | s4 right | s4 left | s5 right | s5 left |
|  | nvUS | RT-PC flow MRI | nvUS | RT-PC flow MRI | nvUS | RT-PC flow MRI | nvUS | RT-PC flow MRI | nvUS | RT-PC flow MRI |
|   | PSV | EDV | FV  | PSV | EDV | FV | PSV | EDV | FV  | PSV | EDV | FV | PSV | EDV | FV  | PSV | EDV | FV | PSV | EDV | FV  | PSV | EDV | FV | PSV | EDV | FV | PSV | EDV | FV |
| 1 | 85.7 | 29.3 | 200.0 | 53.4 | 23.2 | 270.0 | 79.5 | 34.0 | 220.0 | 46.4 | 22.0 | 270.0 | 98.0 | 39.0 | 160.0 | 54.1 | 26.8 | 270.0 | 102.4 | 29.4 | 180.0 | 62.8 | 15.0 | 200.0 | 109.0 | 22.3 | 190.0 | 82.0 | 23.3 | 230.0 |
| 2 | 61.3 | 31.6 | 276.0 | 37.7 | 16.6 | 190.0 | 83.5 | 46.7 | 250.0 | 58.8 | 27.1 | 260.0 | 58.2 | 32.7 | 351.0 | 52.7 | 21.9 | 200.0 | 83.5 | 19.1 | 91.0 | 24.6 | 7.6 | 40.0 | 68.0 | 10.0 | 81.0 | 27.5 | 7.2 | 40.0 |
| 3 | 64.3 | 25.9 | 236.0 | 40.9 | 22.7 | 280.0 | 78.9 | 40.5 | 107.0 | 52.6 | 28.8 | 340.0 | 71.1 | 27.0 | 160.0 | 56.5 | 30.8 | 290.0 | 58.4 | 17.9 | 105.0 | 44.4 | 11.3 | 130.0 | 54.2 | 17.1 | 39.0 | 42.2 | 10.7 | 110.0 |
| 4 | 73.4 | 23.7 | 258.0 | 40.7 | 16.1 | 300.0 | 71.2 | 25.4 | 84.0 | 51.2 | 16.2 | 220.0 | 58.7 | 22.3 | 171.0 | 45.3 | 18.2 | 300.0 | 94.0 | 10.0 | 127.0 | 57.8 | 10.0 | 180.0 | 99.3 | 12.5 | 106.0 | 59.3 | 12.5 | 150.0 |
| 5 | 59.4 | 28.9 | 166.0 | 38.5 | 15.4 | 230.0 | 65.2 | 26.9 | 258.0 | 54.5 | 24.1 | 270.0 | 68.8 | 33.8 | 167.0 | 52.6 | 21.9 | 280.0 | 87.3 | 19.3 | 150.0 | 60.2 | 12.1 | 200.0 | 105.3 | 21.2 | 152.0 | 63.6 | 14.8 | 210.0 |
| 6 | 115.7 | 38.7 | 172.0 | 78.9 | 36.2 | 330.0 | 106.3 | 47.1 | 236.0 | 85.3 | 37.1 | 330.0 | 123.6 | 54.4 | 217.0 | 83.5 | 35.2 | 320.0 | 107.8 | 17.2 | 107.0 | 66.0 | 15.4 | 210.0 | 101.5 | 18.2 | 139.0 | 57.9 | 16.1 | 210.0 |
| 7 | 100.6 | 29.3 | 284.0 | 58.0 | 26.5 | 390.0 | 96.6 | 42.0 | 263.0 | 57.5 | 27.2 | 310.0 | 95.2 | 36.2 | 295.0 | 68.0 | 30.8 | 410.0 | 91.1 | 9.4 | 98.0 | 62.3 | 14.1 | 170.0 | 107.6 | 14.1 | 87.0 | 57.4 | 9.9 | 130.0 |
| 8 | 85.7 | 31.6 | 235.0 | 55.6 | 24.6 | 310.0 | 60.5 | 22.3 | 160.0 | 53.9 | 19.3 | 260.0 | 59.5 | 23.0 | 124.0 | 59.5 | 24.8 | 300.0 | 78.0 | 13.2 | 108.0 | 51.8 | 8.8 | 100.0 | 86.6 | 15.1 | 64.0 | 64.2 | 12.7 | 160.0 |
| 9 | 66.8 | 25.9 | 223.0 | 55.1 | 20.3 | 340.0 | 72.6 | 25.6 | 268.0 | 52.7 | 21.0 | 380.0 | 73.5 | 32.3 | 231.0 | 58.4 | 21.9 | 310.0 | 108.6 | 18.7 | 108.0 | 77.6 | 16.1 | 280.0 | 105.2 | 21.0 | 83.0 | 89.4 | 20.1 | 210.0 |
| 10 | 101.9 | 23.7 | 202.0 | 60.8 | 25.4 | 310.0 | 72.0 | 32.3 | 153.0 | 67.7 | 32.7 | 410.0 | 74.9 | 31.5 | 175.0 | 65.1 | 27.8 | 300.0 | 88.6 | 19.8 | 113.0 | 62.0 | 14.0 | 170.0 | 82.3 | 12.8 | 116.0 | 57.1 | 13.3 | 150.0 |
| 11 | 87.0 | 28.9 | 267.0 | 64.0 | 27.8 | 410.0 | 70.0 | 26.6 | 244.0 | 56.1 | 18.6 | 290.0 | 91.5 | 35.9 | 139.0 | 67.2 | 27.7 | 410.0 | 74.0 | 16.8 | 91.0 | 55.0 | 6.5 | 80.0 | 121.6 | 10.4 | 60.0 | 72.0 | 8.2 | 140.0 |
| 12 | 75.9 | 38.7 | 229.0 | 61.1 | 25.5 | 390.0 | 110.4 | 51.7 | 371.0 | 72.4 | 30.5 | 390.0 | 73.0 | 34.2 | 196.0 | 63.5 | 28.9 | 390.0 | 121.4 | 29.3 | 165.8 | 69.6 | 13.4 | 120.0 | 104.1 | 18.8 | 101.0 | 86.7 | 18.3 | 240.0 |
| 13 | 96.9 | 36.2 | 184.0 | 69.8 | 31.9 | 310.0 | 80.2 | 36.8 | 163.3 | 63.4 | 29.2 | 320.0 | 87.9 | 38.6 | 182.0 | 55.0 | 25.3 | 300.0 | 76.4 | 12.3 | 61.0 | 68.4 | 16.6 | 180.0 | 98.7 | 12.8 | 90.0 | 72.8 | 20.4 | 230.0 |
| 14 | 80.1 | 28.3 | 206.0 | 53.4 | 22.2 | 270.0 | 83.0 | 37.0 | 222.0 | 62.4 | 29.2 | 360.0 | 75.1 | 29.9 | 195.3 | 60.4 | 29.3 | 320.0 | 113.6 | 25.3 | 155.0 | 85.3 | 17.5 | 240.0 | 121.1 | 25.4 | 102.0 | 77.6 | 14.3 | 220.0 |
| 15 | 75.2 | 33.1 | 154.0 | 51.8 | 23.7 | 290.0 | 64.5 | 29.1 | 282.0 | 57.5 | 26.7 | 300.0 | 66.0 | 30.1 | 112.7 | 53.5 | 24.2 | 290.0 | 52.4 | 10.2 | 97.0 | 51.6 | 12.5 | 150.0 | 60.0 | 12.3 | 106.2 | 77.6 | 14.5 | 220.0 |
| 16 | 49.7 | 20.7 | 115.3 | 47.8 | 22.3 | 270.0 | 56.6 | 26.9 | 190.0 | 49.4 | 22.9 | 300.0 | 48.8 | 22.9 | 225.0 | 53.5 | 23.7 | 280.0 | 48.6 | 12.0 | 99.0 | 39.6 | 10.5 | 200.0 | 70.3 | 8.9 | 39.0 | 38.2 | 8.6 | 160.0 |
| 17 | 74.7 | 21.5 | 196.0 | 58.3 | 22.0 | 280.0 | 77.3 | 23.9 | 235.0 | 57.3 | 19.4 | 250.0 | 70.6 | 21.5 | 156.0 | 64.2 | 23.1 | 270.0 | 109.7 | 20.0 | 179.0 | 75.5 | 16.1 | 280.0 | 115.6 | 23.5 | 222.0 | 84.7 | 18.4 | 270.0 |
| 18 | 72.2 | 26.8 | 204.0 | 49.0 | 23.3 | 330.0 | 66.0 | 30.0 | 157.0 | n/a | n/a | n/a | 67.2 | 23.5 | 141.0 | 51.9 | 25.9 | 340.0 | 77.9 | 23.1 | 91.0 | n/a | n/a | n/a | 113.2 | 19.8 | 47.0 | 58.5 | 16.0 | 130.0 |
| 19 | 86.2 | 30.6 | 295.0 | 51.7 | 18.5 | 430.0 | 81.0 | 39.2 | 361.0 | 58.2 | 25.5 | 340.0 | 75.1 | 32.4 | 398.0 | 52.7 | 25.4 | 490.0 | 88.3 | 13.7 | 112.0 | 57.5 | 9.7 | 150.0 | 98.7 | 12.8 | 112.0 | 65.2 | 12.0 | 180.0 |
| 20 | 110.4 | 31.1 | 205.0 | 61.5 | 21.0 | 300.0 | 72.6 | 32.4 | 228.0 | 70.3 | 25.0 | 360.0 | 88.5 | 39.5 | 318.0 | 71.2 | 24.3 | 310.0 | 88.3 | 18.4 | 136.0 | 72.1 | 12.0 | 160.0 | 86.8 | 16.1 | 72.0 | 56.8 | 10.7 | 120.0 |
|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Locations s1 to s5 as in Figure 1; RT-PC flow MRI: real-time phase-contrast flow MRI; nvUS: neurovascular ultrasound; PSV: peak-systolic velocity; EDV: end-diastolic velocity; FV: flow volume |

|  |
| --- |
| **Supporting Table S3.** Comparison of RT-PC MRI flow velocities (cm s−1), flow volumes (ml/min) and end-diastolic vessel diameter (mm2) to nvUS data reported by Scheel et al. [24] |
|  |  |  |  |
|  | RT-PC flow MRI(This study) | nvUS ([24]) | p-value\* |
| PSV CCA  | 84.9 ± 13.2 | 101 ± 22  | **0.010** |
| PSV ICA  | 52.5 ± 8.5 | 72 ± 18 | **<0.001** |
| PSV ECA  | 62.5 ± 14.6 | 86 ± 14 | **<0.001** |
| Flow volume CCA  | 455.5 ± 59.1 | 426 ± 99 | 0.278 |
| Flow volume ICA  | 300 ± 49.1 | 277 ± 49 | 0.157 |
| Flow volume ECA  | 174.2 ± 53.9 | 145 ± 31 | **0.045** |
| End-diastolic vessel diameter CCA  | 7.4 ± 0.6 | 6.0 ± 0.9 | **<0.001** |
| End-diastolic vessel diameter ICA  | 6.2 ± 0.7 | 4.8 ± 0.6 | **<0.001** |
| End-diastolic vessel diameter ECA  | 5.4 ± 0.8 | 4.0 ± 0.4 | **<0.001** |
|  |  |  |  |
| All values are given as mean ± standard deviation; PSV: peak-systolic velocity; EDV: end-diastolic velocity; CCA: common carotid artery; ICA: internal carotid artery; ECA: external carotid artery; \* t-test |