Supplementary Table 1:Summary of normative values of C1 canal diameter reported in the literature.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Authors | Year | Ethnicity | Method | N | C1 canal diameter (mm) |
| Mean ± SD | Range |
| All  | Male | Female |
| Francis[1] | 1955 | Cau.and AA. | Cadaver | 284 | N/A | Cau. 33.1±2.0AA. 32.4±2.5 | Cau. 30.1±1.9AA. 31.1±2.2 | 25-40 |
| Mazzara and Fielding[2] | 1988 | N/A | Cadaver | 103 | 30.1±2.0 | N/A | 25.5-36 |
| Doherty and Heggeness[3] | 1994 | European | Cadaver | 88 | 31.7±2.2 | N/A | N/A |
| König et al[4] | 2005 | European | Cadaver | 30 | 31.0±3.0 | N/A | 26.1-39.4 |
| Şengül and Kadioğlu[5] | 2006 | European | Cadaver | 40 | 31.4±3.5 | N/A | 23.7-46.3 |
| Musha and Mizutani[6] | 2009 | Japanese | X-ray | 300 | N/A | 37.1±2.6 | 34.4±2.4 | 29.4-44.2 |
| Gosavi and Vatsalaswamy[7] | 2012 | Indian | Cadaver | 100 | 27.89±2.59 |  N/A | 22.62-36.56 |
| Kelly et al[8] | 2014 | Cau.and AA. | Cadaver | 543 | 30.8±2.4 | 31.8±2.1 | 29.8±2.2 | 23.5-38.1 |
| Yamahata et al[9] | 2017 | Japanese | CT | 213 | 29.7±2.0 | 30.7±2.0 | 28.9±1.6 | N/A |

Cau: Caucasians; AA: African Americans; N/A: not available; CT: computed tomography.

[1] Francis CC. Dimensions of the cervical vertebrae. *Anat Rec* 1955; 122(4):603-609.

[2] Mazzara JT, Fielding JW. Effect of C1-C2 rotation on canal size. *Clin Orthop Relat Res* 1988; (237): 115-9.

[3] Doherty BJ, Heggeness MH. The quantitative anatomy of the atlas. *Spine*1994; 19(22):2497-2500.

[4] König SA, Goldammer A, Vitzthum HE. Anatomical data on the craniocervical junction and their correlation with degenerative changes in 30 cadaveric specimens. *J Neurosurg Spine* 2005; 3(5): 379-85.

[5] Şengül G, Kadioğlu HH. Morphometric anatomy of the atlas and axis vertebrae. *Turk Neurosurg*2006; 16(2): 69-76.

[6] Musha Y, Mizutani K. Cervical myelopathy accompanied with hypoplasia of the posterior arch of the atlas: case report. *J Spinal Disord Tech* 2009; 22(3): 228-32.

[7] Gosavi SN, Vatsalaswamy P. Morphometric Study of the Atlas Vertebra using Manual Method. *Malays Orthop J* 2012; 6(3): 18-20.

[8] Kelly MP, Oshima Y, Yeom JS, et al. Defining hypolasia of the atlas: a cadaveric study. *Spine* 2014; 39(21):E1243-1247.

[9] Yamahata H, Hirano H, Yamaguchi S, et al. What Is the Most Representative Parameter for Describing the Size of the Atlas? CT Morphometric Analysis of the Atlas with Special Reference to Atlas Hypoplasia. *Neurol Med Chir (Tokyo)* 2017; 57(9): 461-466.

Supplementary Table 2:Summary of measurements and comparison results.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variables | All subjects (n=567) | Male (n=345) | Female (n=222) | *P* value |
| Age (years) | 29.63 ± 6.92 | 29.32 ± 7.29 | 30.12 ± 6.29 | 0.167 |
| C1 canal diameter (mm) | 29.96 ± 1.99 | 30.43 ± 2.02 | 29.24 ± 1.71 | <0.001 |
| Dens (mm) | 10.94 ± 0.53 | 11.01 ± 0.52 | 10.83 ± 0.52 | <0.001 |
| SAC (mm) |  |  |  |  |
|  | C1 level | 18.08 ± 1.49 | 18.32 ± 1.50 | 17.72 ± 1.39 | <0.001 |
|  | C2 level | 18.22 ± 1.20 | 18.46 ± 1.17 | 17.86 ± 1.16 | <0.001 |
|  | *P* value | 0.083 | 0.178 | 0.246 |  |

Data are presented as mean ± standard deviation. SAC: space available for the cord.

Supplementary Table 3: Comparison of parameters between patients with and without C1 hypoplasia based on the threshold (26.07mm).

|  |  |  |  |
| --- | --- | --- | --- |
| Variables | Subjects with C1 canal diameter ≤26.07mm  |  | Subjects with C1 canal diameter >26.07mm |
| All subjects (n=12)  | Male(n=7)  | Female (n=5) |  | All subjects(n=555)  | Male (n=338) | Female(n=217)  |
| Age | 30.08±6.05 | 30.00±6.53 | 30.20±6.06 |  | 29.62±6.94 | 29.30±7.31 | 30.12±6.31 |
| Dens | 10.60±0.37 | 10.84±0.36 | 10.46±0.39 |  | 10.95±0.53 | 11.01±0.53 | 10.84±0.53 |
| C1 SAC | 14.50±0.88† | 14.58±0.91\* | 14.39±0.93‡ |  | 18.16±1.40† | 18.39±1.41\* | 17.80±1.30‡ |
| C2 SAC | 17.71±0.75 | 18.26±0.20 | 17.14±0.84 |  | 18.23±1.21 | 18.46±1.18 | 17.88±1.16 |

Data are presented as mean ± standard deviation. \* P<0.05; †, ‡ P<0.001; SAC: space available for the cord.