Rapid MRI Detection of Vertebral Numerical Variation

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PURPOSE:
Operating at the wrong spinal level is a common cause of medical negligence and may result from imprecise numbering related to the high prevalence of congenital variations. To improve accuracy and standardize spine labeling, we tested a rapid total spine MRI localizer/numbering technique.

Methods:
Automated Spine Survey Iterative Scan Technique (ASSIST) localizers performed as part of a clinical thoracic spine MRI exam were retrospectively reviewed on 207 consecutive patients, 92 males, 115 females, ages 17-88 with a mean age = 48 ±15. All scans were conducted on a 3T MRI with an 8-channel spine array coil and included ASSIST which auto-imaged the entire spine in 2 contiguous 35 cm FOV sagittal stations (11 sections, 4mm skip 1mm), typically utilizing out-of-phase fast gradient echo (FGRE) sequencing (TR/TE = 57/1.4 ms, flip angle =30, BW = +/- 62.5 kHz, 512 x 352 matrix, 21 sec). A board-certified fellowship-trained neuroradiologist and a senior radiology resident, blinded to the clinical report, independently counted, in a cranial to caudal approach, the number of presacral and transitional lumbosacral vertebrae on the total spine localizer. All vertebral variations were confirmed by referencing additional conventional MR sequences acquired as part of the clinical MRI examination. The final exam interpretation was then referenced to determine if the vertebral variation was reported by the neuro-fellow or neuroradiologist.

RESULTS:
In all cases, ASSIST numbering was concordant between the two retrospective readers. Of 210 cases, we found 7 patients with 23 presacral vertebrae, 7 patients with 25 presacral vertebrae and 2 patients with transitional appearing lumbosacral segments. This represents a 7.7% incidence of lumbosacral junction variation consistent with cadaver studies. The clinical MRI report noted anatomic variations in only 5 of the 16 cases; 69% of the vertebral variations went unreported, potentially leading to future labeling discordance.

CONCLUSION:
Accurate vertebral numbering is critical given the relatively high prevalence of numerical variation at the lumbosacral transition. We recommend the use of ASSIST for thoracic or lumbosacral MRI exams. However, simply obtaining ASSIST is not sufficient, as demonstrated by the high percentage of unreported vertebral variation in this study. Counting vertebrae from C2 to the sacrum, either manually or by computer and reporting variants is also essential in the process.