

Title: Cervical facet joint effusion: a sign of instability in cervical degenerative spondylolisthesis

Background:

Aim of this study was to trace the association between cervical facet joint effusion and cervical degenerative spondylolisthesis (CDS). CDS has not received as much attention as its lumbar counterpart. Identification of features of instability on MRI is crucial to avoid missing presence of CDS.

Research question:

to find the correlation between cervical facet effusion and instability

Design:

Case series / observational study

Methods:

Institutional review board (IRB) approval and written informed patient consent was obtained for the retrospective radiographic review of cervical spine MRI scans and upright lateral flexion extension radiographs of consecutive patients at a single institution between January 2017 and June 2018.

The inclusion criteria were patients with signs and symptoms of cervical spondylotic myelopathy with radiographic evidence of CDS.

Patients were excluded from the study if any of the following were present: 1) plain films and MRI taken more than 1 year apart, 2) previous cervical spine surgery, 3) congenital deformity of cervical spine, 4) inflammatory arthritis, 5) cervical fracture or traumatic instability, and 6) malignancy.

MRI images were captured digitally and viewed using MRI scanner (Philips Achieva 3T TX; Philips Healthcare, Best, Netherlands) and measurements were obtained using the digital measuring tools included in the software. Sagittal and axial T2-

weighted images were reviewed. All images were acquired on 1.5 Tesla machines with slice thickness of 3mm. For sagittal images, typical matrix was 300 X 512 mm with a field of view of 25 cm. For axial images, typical matrix was 300 X 512 mm with a field of view of 15 cm.

A facet effusion was defined as a measurable, curvilinear, high intensity signal within the facet joint, which resemblances to that of cerebrospinal fluid on the axial T2 images. The measurement was taken perpendicular to the apparent joint line, and the largest value was recorded as effusion size.

Cervical spondylolisthesis is defined as horizontal displacement of one vertebra with relation to vertebra immediately below, which was measured on upright neutral and lateral flexion extension radiographs using Taillard method. Kawasaki grading system was applied to grade the extent of displacement. According to Kawasaki et al, displacement is graded as follows: grade 1 (<2 mm), grade 2 (2 to 3.49 mm) and grade 3 (>3.5mm).

Case 1: A 73-year-old male presented with signs and symptoms of cervical spondylotic myelopathy with sagittal T2 MRI image (Fig 1a) revealing CDS and compression at C3-4. The left sided facet effusion (Fig 1b) presented a hint that it was mobile as was demonstrated in flexion-extension radiographs (Fig1c) and intra-operatively on positioning (Fig 1d) Patient underwent anterior cervical discectomy and fusion (Fig 1e).

Results:

A total of 17 patients fulfilled the inclusion criteria of cervical spondylotic myelopathy associated with CDS. Eleven patients revealed spondylolisthesis at C4-C5 level and 6 patients at C3-C4 level. Out of these, 10 patients revealed facet joint effusion at C4-C5 (6 patients) and C3-C4 (4 patients) levels (Table 1). There were 12 males (70.58%) and 5 females (29.41%). The mean age of patients was 65.8 years (49-79). The amount of facet joint effusion varied and ranged from 1.6 mm to 4.7

mm. All ten patients (58.82%) demonstrated facet joint effusion associated with CDS with translation of vertebra more than 3.5 mm (Grade 3), 3 mm (Grade 2) and 2mm (Grade 1) in 6 (66.6%), 3(33.3%) and 1(11%) patients respectively. All patients underwent surgery; five patients equally underwent an anterior and posterior fusion. The seven patients (41.17%) with CDS and without facet effusion did not demonstrate mobility > 0.5 mm in flexion-extension radiographs and underwent decompression alone.

Discussion:

Cervical degenerative spondylolisthesis (CDS) has not received as much attention at its lumbar counterpart. One of the reasons could be the low incidence of CDS as compared to lumbar degenerative spondylolisthesis (LDS). The incidence is mentioned to be as low as 5.2% in patients undergoing radiographic studies for symptoms unrelated to the cervical spine. This is also evident in the current study where only 17 patients presented with upper cervical degenerative spondylolisthesis in a time period of 1.5 years. Again, a study showed that in majority of times, in extremely elderly patients with cervical spondylotic myelopathy (CSM), CDS involves the upper cervical levels, namely C3-4 and C4-5. In the current study too, the site of CDS was restricted to the upper cervical levels. The tendency to involve upper cervical levels and that too especially in the elderly is probably because of progressive degeneration and stiffening of the lower cervical levels with age. It might be the only site of conduction block in a patient with CSM and hence needs attention in the form of fusion along with decompression. Therefore, it becomes vital to have a high index of suspicion to rule out dynamic instability in cases of CSM extending to or involving the upper cervical levels.

In spite of insistence on baseline radiographs and importance of flexion-extension radiographs, it is common in clinical practice to notice that treatment decisions are executed based on MRI alone, because of its wider availability. Again, increasing

dependence on teleconsultation and expansion of virtual clinics limit adequate clinical assessment and the surgeon is challenged to make decisions based on radiological material made available. Hence, recognition of signs of instability on MRI then assumes significance. Chaput et al have described facet joint asymmetry and hypertrophy on MRI as features of CDS. Based on MRI, Chaput et al as well as several authors have described facet joint effusion as a sign of instability in the lumbar spine. The presence of this particular feature has been considered to be one of the key factors to be accounted to decide the need for fusion in cases of lumbar degenerative spondylolisthesis in a recently published classification.

The authors noted facet effusion in the cervical spine at C3-4 and C4-5 levels in 10/17 patients presenting with myelopathy at the upper cervical levels (C3-4 and C4-5). The patients presented with ataxia, motor weakness and paresthesia in the extremities as well as bladder and bowel incontinence. The history was of gradual onset and progression without any incidence of trauma. The implications of appreciating the presence of facet effusion are manifold. In a patient who reveals degenerative spondylolisthesis as well as facet effusion on MRI (Fig 2a), the presence of effusion will prompt the clinician to perform flexion-extension radiographs to check whether the segment is mobile or fixed (Fig 2b). This is significant because the clinician may assume that the listhesis is fixed since MRI is generally done with neck in extension, a position in which the listhesis gets reduced. More commonly, the situation may be diametrically opposite. Since MRI is generally performed with neck in extension and the listhesis gets reduced in extension, the presence of mobile CDS may be masked and hence missed (Fig 2c). In such a situation, recognition of facet effusion on MRI should prompt the clinician to rule out dynamic instability, which obviously dictates the treatment strategy. The presence of facet effusion can be appreciated on the parasagittal T2-weighted images also (Fig 2d). At the time of presentation to the authors, the effusion was uniformly

unilateral in all patients. This may be just one of the intermediate phases of degeneration on the way to gradual progression to bilateral effusion as a result of progressive slip. On the side of effusion, the effusion does not occupy any potential space but is a result of progressive erosion and attrition of the articular surfaces of the lateral masses. This results in atrophy of the lateral masses and may prohibit insertion of lateral mass screws. However, the site of effusion can be an excellent host area and can be packed with significant amount of bone graft. The contralateral facet joint was not associated with any trace of effusion in the cases treated with posterior approach. This assumes critical importance from the point of stabilization, since lateral mass fixation is possible on the contralateral side.

In the current study, 10/17 (58.82%) of patients with CDS had evidence of facet effusion. Lattig et al noticed a meaningful degree of facet effusion in 108/160 (67.5%) of patients with lumbar degenerative spondylolisthesis. The incidence in the series published by while Cho et al and Caterini et al was 53%. Lattig et al submitted that not every patient with degenerative spondylolisthesis demonstrated facet effusion. Chaput et al rightfully consider lumbar degenerative spondylolisthesis to be a by-product of Kirkaldy-Willis theory of lumbar disc degeneration. They believe that patients with lumbar degenerative spondylolisthesis and evidence of facet effusion belong to the stage of instability. Furthermore, they comment that those patients with lumbar degenerative spondylolisthesis without effusion have severe arthritic changes and belong to the stage of re-stabilization. This can explain the reason as to why 7/17 patients in our study did not reveal any effusion, demonstrated significant arthritic changes in the facet joints and revealed minimal mobility in flexion-extension radiographs.

It is now generally accepted that with regards to the lumbar spine, effusions >1.5 mm are associated with a slip. However, as highlighted above, CDS is not as commonly encountered in clinical practice in comparison to lumbar degenerative

spondylolisthesis. Larger multi-centric studies will be adding to our current understanding of CDS and its relation to effusion and the need for fusion. However, the current study does for the first time acknowledge the association of ‘cervical facet effusion’ and cervical degenerative spondylolisthesis.

Conclusion: The current study acknowledges the association of ‘cervical facet effusion’ and cervical degenerative spondylolisthesis (CDS). Clinically measurable facet joint effusion on MRI suggests the need for further attempts to diagnose CDS.