Original Article

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

ABSTRACT

Aims: The 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 magnetic resonance imaging (MRI) is crucial to avoid missing presence of CDS.

Materials and Methods: The authors retrospectively reviewed cervical spine MRI scans and upright lateral flexion-extension radiographs of 17 consecutive patients at a single institution between January 2017 and June 2018 that revealed CDS. Presence of cervical facet joint effusion and CDS was recorded. Data were analyzed to deduce possibility of an association between cervical facet joint effusion and CDS.

Results: Seventeen patients fulfilled the inclusion criteria of cervical spondylotic myelopathy associated with CDS. Out of these, 10 patients revealed facet joint effusion at C3-C4 (4 patients) and C4-C5 (6 patients) levels. The mean age of patients was 65.8 years (49–79) and M:F was 2.2:1. Amount of facet joint effusion varied and ranged from 1.6 mm to 4.7 mm on the axial images. Ten patients (58.82%) demonstrated facet joint effusion associated with mobile CDS. Seven patients (41.17%) with CDS and without facet effusion did not demonstrate mobility of more than 0.5 mm in flexion-extension radiographs.

Conclusion: The current study acknowledges the association of "cervical facet effusion" and CDS. Clinically measurable facet joint effusion on MRI suggests the need for further attempts to diagnose CDS.

Keywords: Degenerative spondylolisthesis, facet joint, myelopathy, spinal fusion, spinal instability

INTRODUCTION

Dynamic radiographs are generally utilized to diagnose spinal instability. This is important to decide if a patient needs decompression alone and/or fusion. It is usual to notice patients presenting to outpatient clinics with only magnetic resonance imaging (MRI) films and no radiographs in view of the wider availability of MRI. In a busy clinic, an oversight leading to lapse on the side of the surgeon of not advising and procuring dynamic radiographs can lead to an error in treatment. Increasing relevance in virtual consultations and teleconsultations, especially pertaining to the elderly population (generally suffers from upper cervical degenerative spondylolisthesis [CDS]) that do not want to be exposed to the coronavirus, has triggered the need for a diagnosis based more on radiological images and less on clinical evaluation. Hence, it is wise to understand the features on MRI that are suggestive of instability and can pave the way for dynamic radiographs for confirmation of instability. With regard to lumbar spine, certain MRI features of instability related to facet joint orientation, facet joint arthritis, and presence/absence of synovial cysts are well known.[1-3] Facet joint effusion has gained significant importance as a "tell-tale" sign of mobile degenerative spondylolisthesis,[4] so much so that patients with

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"stable" degenerative spondylolisthesis did not demonstrate facet effusion on the MRI. In a similar vein, identification of cervical instability is important in decision-making. While dynamic radiographs may detect abnormal cervical motion, it is important to recognize features expressed on the MRI that suggest instability. While facet joint asymmetry and hypertrophy have been suggested as features of cervical instability,[5] "cervical facet effusion" has not been highlighted and discussed as an important sign of CDS. The aim of this study was to present a series of cases where there was a clear correlation between cervical facet effusion and CDS.

MATERIALS AND METHODS

Institutional review board and ethical committee approval and written informed patient consent were 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 (CSM) 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 3TTX; Philips Healthcare, Best, The 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 3 mm. For sagittal images, typical matrix was 300 mm × 512 mm with a field of view of 25 cm. For axial images, typical matrix was 300 mm × 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.[6]

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.[7] 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 (2–3.49 mm), and Grade 3 (>3.5 mm).[8]

Case 1

A 73-year-old male presented with signs and symptoms of CSM with sagittal T2 MRI image [Figure 1a] revealing CDS and compression at C3-4. The left-sided facet effusion [Figure 1b] presented a hint that it was mobile as was demonstrated in flexion-extension radiographs [Figure 1c] and intraoperatively on positioning [Figure 1d]. The patient underwent anterior cervical discectomy and fusion [Figure 1e].

RESULTS

A total of 17 patients fulfilled the inclusion criteria of CSM 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 2 mm (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

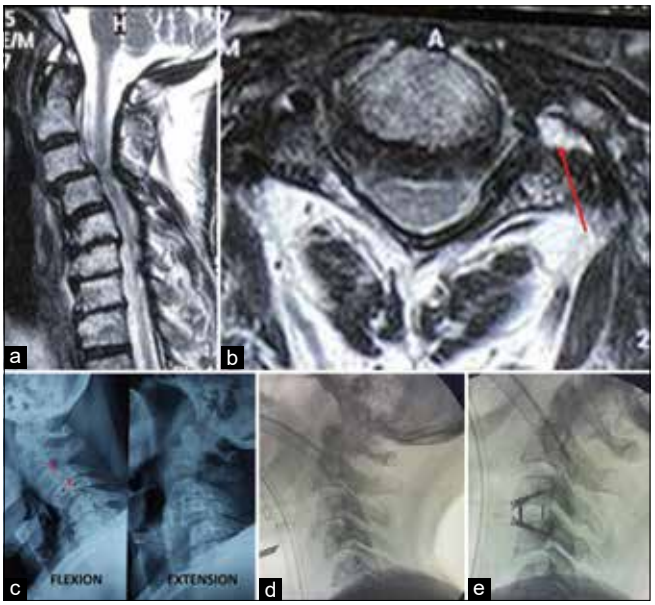

Figure 1: (a) T2-weighted sagittal magnetic resonance imaging image showing cervical spondylotic myelopathy revealing cervical degenerative spondylolisthesis and compression at C3-4. (b) T2W axial image showing left-sided facet joint effusion. (c) Flexion-extension radiograph revealing mobile cervical spondylolisthesis. (d) Reduction of cervical spondylolisthesis intraoperatively on positioning. (e) Postoperative image of C3-C4 ACDF

mobility >0.5 mm in flexion-extension radiographs and underwent decompression alone.

DISCUSSION

CDS has not received as much attention at its lumbar counterpart.[9] One of the reasons could be the low incidence of CDS[10-13] 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 CDS in a time period of 1.5 years. Again, a study[14] showed that in majority of times, in extremely elderly patients with 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.[14] 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[5] as features of CDS. Based on MRI, Chaput *et al*. as well as several authors[6,15] 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 LDS in a recently published classification.[16]

Table 1: Demographic data and cervical facet effusion in mm

Age	Sex	Facet effusion	Amount of facet effusion (mm)
74	Male	P (C4-C5)	4.7
70	Male	P (C3-C4)	2.8
49	Female	P (C4-C5)	1.9
58	Male	P (C4-C5)	2
76	Female	P (C4-C5)	1.6
69	Male	P (C3-C4)	1.8
62	Male	P (C3-C4)	3.2
63	Male	P (C4-C5)	1.6
79	Female	P (C4-C5)	2.5
73	Male	P (C3-C4)	2.1

P - Facet effusion present

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 [Figure 2a], the presence of effusion will prompt the clinician to perform flexion-extension radiographs to check whether the segment is mobile or fixed [Figure 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 [Figure 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 [Figure 2d]. At the time of presentation to the authors, the effusion was uniformly unilateral in all

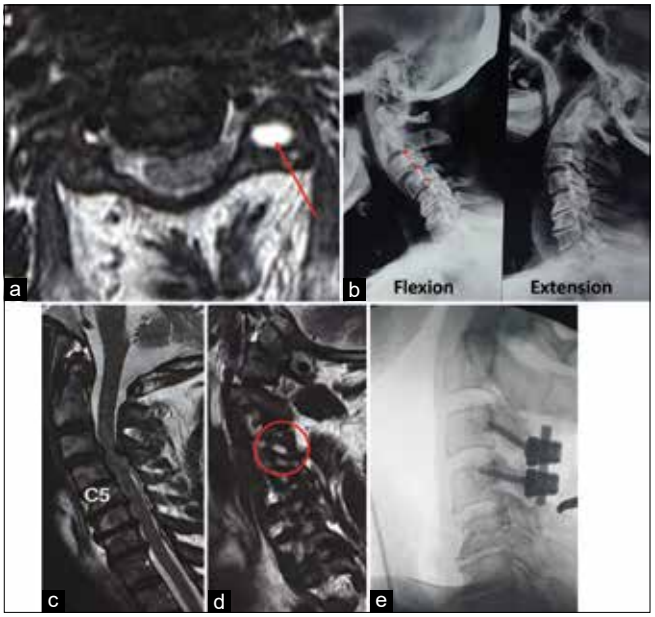

Figure 2: (a) T2-weighted axial magnetic resonance imaging image of a myelopathic patient demonstrating facet effusion = 4.7 mm. (b) Flexion-extension radiograph revealing mobile degenerative cervical spondylolisthesis. (c) T2-weighted sagittal magnetic resonance imaging image showing reduction of spondylolisthesis in extension. (d) Parasagittal T2-weighted image demonstrating facet effusion. (e) Lateral mass fixation done on the contralateral side

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, or facet joint spacers.[17] 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 [Figure 2e].

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 LDS.[4] The incidence in the series published by while Cho *et al*. and Caterini *et al*. was 53%.[1] Lattig *et al*. submitted that not every patient with degenerative spondylolisthesis demonstrated facet effusion. Chaput *et al*. rightfully consider LDS to be a by-product of Kirkaldy-Willis theory of lumbar disc degeneration.[18] They believe that patients with LDS and evidence of facet effusion belong to the stage of instability. Furthermore, they comment that those patients with LDS 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 regard to the lumbar spine, effusions >1.5 mm are associated with a slip.[6] However, as highlighted above, CDS is not as commonly encountered in clinical practice in comparison to LDS. Larger multicentric 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 CDS.

CONCLUSION

The current study acknowledges the association of "cervical facet effusion" and CDS. Clinically measurable facet joint effusion on MRI suggests the need for further attempts to diagnose CDS.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understands that his name and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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