

Treatment of Isolated “Floating Lateral Mass” Fractures of the Cervical Spine: A Case Series

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ABSTRACT

Introduction: We report a series of patients with “floating lateral mass” cervical fractures, focusing on the role of disc injury in potential segmental instability. **Materials and Methods:** We conducted a descriptive and retrospective study on a case series of isolated floating lateral mass facet fractures diagnosed between January 1, 2016 and January 1, 2022. Patients with floating lateral mass lesions according to the AO classification, diagnosed by computed tomography, and at least 6 months of follow-up were included. Patients with pathological fractures, bone fragility injuries and incomplete records were excluded. **Results:** We included 16 cases, the average age was 42.86 (SD 12.396), and the majority were male (n=13; 81.25%). 68.75% (n=11) had intervertebral disc injury in the fractured segment, while 18.75% (n=3) had anterolisthesis. Conservative treatment was proposed for 12 weeks in 11 patients (68.75%), of whom 5 (45.4%) achieved fracture healing and 6 (54.6%) progressed to translation. Cases where conservative treatment failed were associated with intervertebral disc injury. Eleven patients were treated surgically, mostly with monosegmental anterior cervical arthrodesis. **Conclusions:** We report a series of cases in which the existence of an associated intervertebral disc injury was more frequent in patients with failed conservative treatment and in those initially treated with arthrodesis. Most of the surgical cases were treated using an anterior approach with discectomy and anterior cervical arthrodesis at a single level, with favorable outcomes.

Keywords: Facet fractures; cervical; trauma; floating lateral mass; F3.

Level of Evidence: IV

Tratamiento de las fracturas cervicales aisladas de tipo “masa lateral flotante”: serie de casos

RESUMEN

Objetivo: Presentar una serie de casos de pacientes con fracturas cervicales de tipo “masa lateral flotante” con énfasis en describir el rol de la lesión discal en la potencial inestabilidad segmentaria. **Materiales y Métodos:** Se realizó un estudio descriptivo y retrospectivo de una serie de pacientes con fracturas facetarias de tipo “masa lateral flotante”, aisladas, diagnosticadas entre el 1 de enero de 2016 y el 1 de enero de 2022. Se incluyeron pacientes con lesiones de tipo “masa lateral flotante” según la clasificación AO, diagnosticadas por tomografía computarizada y, al menos, 6 meses de seguimiento. Se excluyó a aquellos con fracturas patológicas, lesiones por fragilidad ósea y registros incompletos. **Resultados:** Se analizó a 16 pacientes (media de la edad 42.86; DE 12,396), con predominio del sexo masculino (81,25%). El 68,75% tenía una lesión del disco intervertebral en el segmento fracturado y el 18,75%, anterolistesis. A 11 pacientes se les propuso un tratamiento conservador durante 12 semanas. La fractura consolidó en el 45,4% y 6 (54,6%) evolucionaron con traslación. El fracaso del tratamiento conservador se asoció con lesión del disco intervertebral. Once pacientes fueron operados, en su mayoría, con artrodesis cervical anterior monosegmentaria.

Conclusiones: En esta serie de casos, la presencia de una lesión asociada del disco intervertebral fue más frecuente cuando el tratamiento conservador fracasó y cuando se decidió una artrodesis como tratamiento inicial. La mayoría de las cirugías se realizaron por vía anterior con discectomía y artrodesis cervical anterior en un único nivel, y se lograron buenos resultados.

Palabras clave: Fracturas facetarias; cervical; trauma; masa lateral flotante; F3.

Nivel de Evidencia: IV

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INTRODUCTION

Floating lateral mass facet fractures are a unique subset of cervical spine fractures and comprise approximately 10% of all subaxial fractures.^{1,2} The AO classification system for subaxial cervical spine injuries groups facet injuries into four types (from F1 to F4).³ Type F3 includes injuries called floating lateral mass, characterized by simultaneous fractures of the pedicle and lamina that result in the disconnection of the superior and inferior articular processes at a given level, posing the risk of mechanical instability, and their treatment is controversial.^{1,2,4} These fractures often go unnoticed, because they are difficult to diagnose on simple radiographs and usually occur with minimal or no displacement.¹⁻⁴

The treatment for this particular group of cervical injuries is still controversial.⁵ The indications for orthopedic treatment are not yet clear, as are the factors associated with the failure of conservative treatment.¹⁻⁷ In published cases, anterior cervical discectomy and fusion of one or more levels and three-level posterior fusion have been described as possible surgical alternatives for these injuries.⁶ Previous publications suggest that the state of the intervertebral disc of the injured segment is a key variable for decision-making.⁶ In this way, when the disc is not injured, orthopedic treatment may be indicated. In addition, in surgical cases, the anterior fusion depends on the condition of the adjacent discs. When there is no additional disc involvement to the injured segment, single-level fusion is allowed, with good functional and radiological outcomes.⁶

The objective of this article is to report a series of patients with *floating lateral mass* cervical fractures with an emphasis on describing the role of disc injury in potential segmental instability.

MATERIALS AND METHODS

A descriptive and retrospective study was conducted on a series of isolated cases of *floating lateral mass* facet fractures diagnosed between January 1, 2016 and January 1, 2022, at a single Center.

Patients with *floating lateral mass* injuries according to the AO classification ([Figure 1](#)), diagnosed by computed tomography (CT) and with at least six months of follow-up, were included.³ Fractures of the subaxial cervical spine with simultaneous involvement of the pedicle and lamina, resulting in the disconnection of the superior and inferior articular processes at a given level, were classified as *floating lateral mass* or F3.

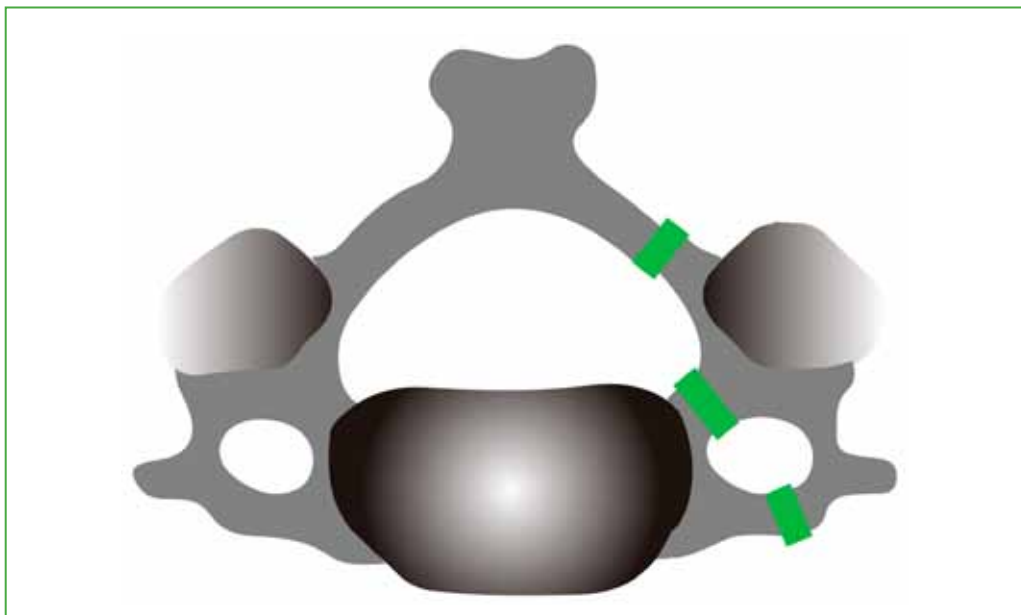


Figure 1. Graphic describing the characteristics that define type F3 fractures (or *floating lateral mass*) according to the AO classification. The green lines represent the topography of the fracture lines, where the lateral mass is disconnected from the rest of the vertebra, constituting a potentially unstable injury.

We only included isolated facet injuries without evidence of ligament injury or translation (type B or C of the AO classification, respectively) in the complementary images upon admission (radiographs, CT and magnetic resonance imaging [MRI]). Patients with pathological fractures, injuries due to bone fragility and incomplete medical records were excluded.

The following variables were recorded: age, sex, neurological status according to the ASIA disability scale (*American Spinal Injury Association Impairment Scale, AIS*),⁸ type of treatment (orthopedic or surgical), number of segments operated, type of approach (anterior, posterior or combined anterior-posterior), disc injury (according to MRI), displacement (fractures with anterolisthesis >2 mm, according to CT) and fracture consolidation according to radiographs after six months.

Categorical variables are expressed in number and percentage; and numerical variables are expressed according to mean or median with their respective measures of dispersion, standard deviation (SD) and range. For the statistical description of the sample, the SPSS Statistics 25 program was used.

RESULTS

16 patients were included, the average age was 42.86 (SD 12,396) years and the male gender predominated (n = 13; 81.25%). All patients were evaluated with CT and MRI. 68.75% (n = 11) had an intervertebral disc injury in the fractured segment (**Figure 2**) and 18.75% (n = 3) had tomographic evidence of anterolisthesis. None suffered an associated neurological injury (AIS E n = 16).



Figure 2. Computed tomography of the cervical spine. **A.** *Floating lateral mass facet fracture.* **B.** Intervertebral disc injury in the C5-C6 segment. **C and D.** Dynamic radiographs of the cervical spine. Signs of instability during image intensifier evaluation in the operating room.

Eleven patients (68.75%) were offered conservative treatment with a rigid cervical collar for 12 weeks. The fracture consolidated in five of them (45.4%) and six (54.6%) underwent translation during follow-up with definitive surgical treatment. It should be noted that all patients with successful conservative treatment did not present an intervertebral disc injury or tomographic evidence of translation (Figure 3). Conversely, unsuccessful cases had MRI evidence of disc injury (which was later hierarchized) or translation during follow-up.

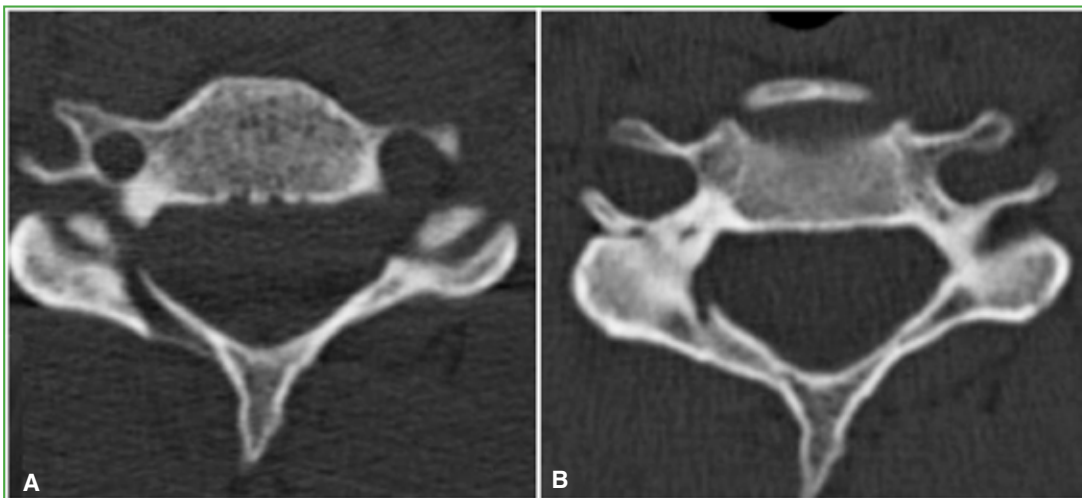


Figure 3. An example of an isolated *floating lateral mass facet fracture*. Computed tomography of the cervical spine. **A.** Upon admission. **B.** After 6 months. Conservative treatment with a rigid collar for 12 weeks with fracture consolidation.

Finally, 11 patients underwent surgery (initial surgery: $n = 5$; surgery as a rescue of failed conservative treatment: $n = 6$) (Figure 4). Of this group, only one patient required a two-level anterior cervical discectomy and fusion procedure. The rest underwent anterior single-level cervical disc fusion. A complementary posterior arthrodesis was performed in only one case.



Figure 4. An example of an isolated *floating lateral mass facet fracture*. CT scan of the cervical spine, axial section (**A**), parasagittal sections (**B** and **C**). Magnetic resonance imaging suggests an associated intervertebral disc injury (**D**). Lateral radiograph of the cervical spine. Evidence of translation in the C5-C6 segment during follow-up (**E**). Surgical treatment with single-level anterior cervical discectomy and fusion (**F**).

After six months of follow-up, the consolidation rate was 93.75% (n = 15), regardless of the treatment initiated. Only one patient treated with anterior single-level cervical disc fusion had no consolidation on follow-up CT, with no clinical repercussions.

DISCUSSION

F3 facet fractures are rare among cervical injuries, the current literature on this topic is scarce and the indications for orthopedic management are not yet clear.²

There is uncertainty regarding the risk factors for the displacement of facet fractures or the possible failure of conservative treatment. However, we can highlight some variables that arise from the analysis of the literature, such as a high body mass index, the degree of comminution of the fracture, the presence of radiculopathy as an initial clinical manifestation, tomographic evidence of listhesis >2 mm, involvement of more than 40% of the absolute height of the facet (compared to the contralateral facet), an articular fragment of the fractured facet >1 cm, and the injury of three of four ligaments including the joint capsule, the anterior longitudinal ligament, the posterior longitudinal ligament, and the interspinous ligament.^{1,2,4-6}

Of the risk factors mentioned in the literature, in our series, intervertebral disc injury predominated as a risk factor for potential instability and failure of conservative treatment. Although evaluating the relative risk is beyond the scope of this study, since it is a description of a series of cases, we consider it relevant to support the authors' hypothesis that all patients in whom conservative management failed had signs of disc injury on MRI. At present, evidence is scarce on this relationship. Caravaggi et al. conducted an *in vitro* biomechanical study where they observed that a facet fracture associated with a concomitant disc injury generated a significant increase in the range of motion in flexion, lateral flexion and axial rotation, altering the intervertebral kinematics at the level of the injury.⁷ As suggested in the literature, our findings of concomitant disc injury on MRI may indicate a greater likelihood of segmental instability in isolated facet fractures.^{6,7}

It should be clarified that multicenter cohort studies are needed to obtain a representative number of patients for each predictive variable mentioned in the literature and thus estimate the relative risk between intervertebral disc injury, as well as other predictive factors, and conservative treatment failure. Our series did not include a significant number of patients with high body mass index, severe fracture comminution, or voluminous facet fragments that would allow for analysis.

There was great variability in the success rate of conservative treatment of isolated, *floating lateral mass* cervical facet fractures. According to Manoso et al., 75% of patients who received conservative treatment developed instability that led to definitive surgery.⁴ Vedantam et al. reported a 33% failure rate for conservative treatment.⁹ It should be noted that Prezelski et al. documented transient instability in 20% of the cases, although without the need for rescue surgery.¹⁰

Most of the surgeries were performed using single-level anterior cervical disc fusion without complementary posterior arthrodesis (9 cases) and the fracture healed in 90% of these cases. This adds to the existing evidence that supports this intervention as a viable treatment for isolated *floating lateral mass* facet fractures.^{1-8,10}

The weaknesses of this study are its descriptive nature and the small number of patients; however, it represents a large series compared to other published international studies. It provides information that supports the hypothesis about disc injury as a risk factor for the failure of conservative treatment of *floating lateral mass* fractures. However, more research is needed to assess the above-mentioned relationship.

CONCLUSIONS

Isolated *floating lateral mass* facet fractures may be treated with a rigid collar or require surgery because of their potential segmental mechanical instability. In our case series, the presence of an associated injury to the intervertebral disc was more common when conservative treatment failed or when arthrodesis was decided as the initial treatment. Most surgeries involved single-level anterior cervical discectomy and fusion, and good outcomes were achieved. The state of the adjacent discs in the MRI was used as the main criteria for selecting fusion levels.

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