Surgical management of facet joint cysts: a retrospective analysis & comparison of the two main operative techniques

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Abstract

Introduction: Facet cysts have been known to be a source of back and radicular pain since 1950. Symptomatic cysts are eventually managed surgically, either with posterior decompression or decompression with concomitant fusion. However, with studies comparing the two methods producing opposing conclusions, the definitive treatment option remains indeterminate.
Methodology: 47 patients, all with symptomatic FJCs, were selected from a database of spinal operation notes. Pre-operative MRI scans were analysed to search for factors associated with their development, namely the orientation of the facet joint, the presence of spondylolisthesis and whether there was an effusion present. Patient clinical notes and correspondence letters were used to establish the symptoms experienced by patients, both prior to and following intervention, along with the rates of intra-operative complications, cyst recurrence and re-operation. This allowed for comparison between decompression-alone and decompression-fusion.
Results: Patients were 64.03 $\pm$ 12.334 at the time of operation. Factors associated with the development of FJCs were prevalent in several cases; spondylolisthesis was present in 36% of cases, a facet effusion in 82.2% and facet angles at L4/5 were more sagittal in orientation compared to that of healthy patients in a different study. Patients with spondylolisthesis or larger cysts (classified according to canal compromise %) were no more likely to undergo fusion than other patients in the study group. Intra-operative complications – dural tears (n = 3) and CSF leaks (n = 1) – occurred only in the fusion group, and the volume of blood loss tended to be greater (p = .001). No significant differences were found in rates of back pain (p =.864) and radiculopathy (p = .625) with subsequent follow-up. Revision rates and incidences of cyst recurrence were also similar (p = .674, p = .300 respectively).
Conclusions: With similar post-operative outcomes between decompression-alone and decompression-fusion, the complication rates associated with fusion, albeit low, suggest that decompression-alone should be a first-line option for the initial surgical management of symptomatic FJCs. In the rare event that a cyst may recur, a revision-fusion may be carried out.

Introduction

Facet joint cysts (FJCs) are well-circumscribed cystic lesions which arise when the integrity of the facet joint capsule is compromised, leading to an outpouching of synovial fluid (1, 2). Although many are asymptomatic, larger cysts may compress on exiting nerve roots, leading to back pain, radiculopathy, neurogenic claudication, bladder dysfunction and rarely, cauda equina syndrome (3-5). At present, there remains little definitive guidance on the management of symptomatic facet joint cysts. Refractory cases, unresponsive to conservative treatment – physiotherapy, analgesics and spinal injections (6) – are treated surgically, either by posterior decompression or decompression with fusion (5). However, the consensus on which technique is most optimal remains highly disputed (7).

Facet cysts have been long thought to develop in association with micro-instability within the spine (7-9). In fact, the presence of spondylolisthesis (10, 11) and the orientation of the facet joint (12, 13) have both been linked with their development (14).

Facet cysts are also known to occur most commonly at the level of L4/5 which is the level that demonstrates the greatest range of motion within the spine (3, 5, 15). As such, decompression-fusion, which effectively limits movement altogether, remains a popular choice by spinal surgeons. In fact, many published works have previously favoured fusion in light of the theory that decompression-alone might "unmask latent instability" (16) in select patients (5, 17). Despite this, it appears that the benefits associated with fusion, namely in reducing cyst recurrence and improving symptoms post-operatively (7) come at an unfortunate cost. A retrospective study by Xu et al. (5) elucidated that decompression-fusion carried an increased risk of dural tears and blood loss intra-operatively. All instances of infection, wound dehiscence, CSF leakage and VTE in fact, were in patients who had fusion (5). While not all literature has been able to replicate such findings (7, 18), there is also the matter of adjacent segment disease. It is a well-accepted fact that fusion may lead to degenerative changes above and below the level of fusion and this, in time, may lead to subsequent spinal pathology and necessitate re-operation (19-22).

Aims and Objectives

Since the first documented case was reported by Vosschulte and Borger in 1950 (23), numerous academic papers have debated the aetiology and management of symptomatic FJCs. We aim to explore the patient demographics, radiological findings and post-operative outcomes of patients which underwent surgical excision for FJCs. Our research takes place over a 10-year period and involves a comparison of the two main operative techniques: decompression-alone and decompression-fusion.

Methodology

Patients were identified and selected from spinal operation notes documented on the *Bluespier* database. Searches were performed annually from 01/01/2014 – 01/01/2024. Out of 4,963 operation notes, 47 contained the keyword "cyst" and were subsequently found to have facet cysts.

Year	Documented spinal operation notes (n)	Relevant to study (n)
2014	496	2
2015	470	9
2016	571	5
2017	579	6
2018	503	2
2019	471	3
2020	341	2
2021	443	4
2022	378	5
2023	442	9
Total	**4967**	**47**

Table 1: Spinal operation notes available per year and the cases relevant to the study.

Notes were individually analysed to establish the location of the facet cyst, the type of operation performed, whether operations were primary or revisions and to establish the incidence of intra-operative complications such as dural tears and CSF leaks. The

approximate volume of blood loss in ml was also collected and grouped into three categories: <200, 200-500 and 500-1,000.

Clinical notes

Clinic notes and correspondence letters were used to ascertain the symptoms experienced by patients prior to intervention, whether symptoms improved in the immediate post-operative period and, perhaps more importantly, whether symptoms had recurred with subsequent follow-up. WCP was also used to assess how many individuals required re-operation and whether anyone had experienced a symptomatic recurrence. Out of 47 patients, 4 could not be fully followed-up; three patients had died, and one patient had no documentation available.

Radiological analysis

42 patients had pre-operative MRI scans available for analysis. Using the 'freehand' tool on *Synapse PACS*, the approximate surface area of the spinal canals and facet cysts were measured. From this, the percentage of canal compromise was calculated. In accordance with the current literature, the angle of the facet joint was obtained in the transverse plane, at the point of intersection between the midsagittal line and the facet line (24, 25). An average of three measurements was calculated to minimise human error. Finally, it was noted whether there was spondylolisthesis present and whether there was an effusion in the facet joint. This was previously defined by Chaput et al. as a facet gap measuring ≥1mm (26). Findings were verified using the corresponding MRI reports.

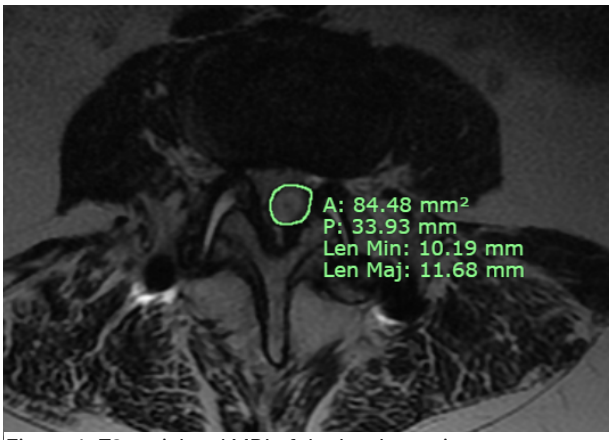

Figure 1: T2-weighted MRI of the lumbar spine, transverse plane. 'Freehand' tool was used to estimate the surface area of the facet cyst and the spinal canal at the corresponding level.

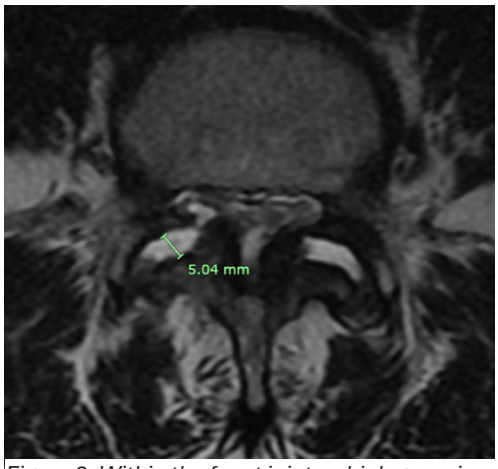

Figure 3: Within the facet joints which gave rise to cysts, the widths of the effusions were measured at the widest point, in the transverse plane.

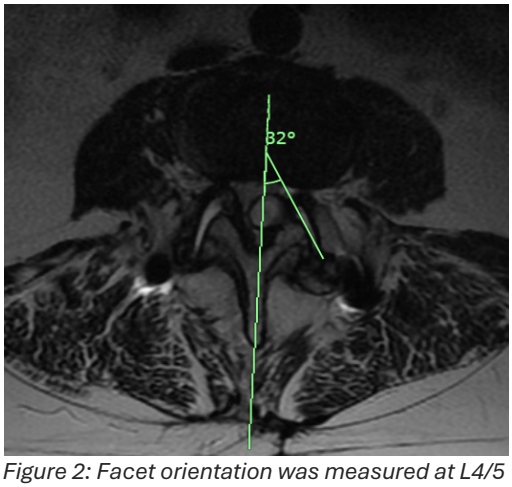

Figure 2: Facet orientation was measured at L4/5 in the transverse plane.

Data analysis

IBM SPSS statistics (version 29) was used for data analysis. Unpaired t tests were carried out to establish whether those who underwent fusion had a higher percentage of canal compromise. The same test was also undertaken to compare the mean facet angle at L4/5 with that of healthy participants in a study by Mohanty et al. (27). A Chi-squared test was used to evaluate whether the incidence of spondylolisthesis was higher in the fusion group. An ANOVA test was conducted to compare the complication rates between patients who underwent decompression-alone and decompression-fusion. Finally, a second Chi-square test was used to compare the incidences of post-operative symptom recurrence, revision rate and cyst recurrence between the two operations.

Results

Patient demographics

Out of 47 patients, 59.6% were female and 40.4% were male. Patients were 64.03 ± 12.334 on average when they underwent surgical excision. Pre-operative symptoms were categorised into radiculopathy, back pain, neurological deficit (sensory or motor), bladder or bowel disturbance and neurogenic claudication. Radiculopathy was the most commonly reported symptom, with 87.2% having documented to experience it. This was followed by back pain (78.7%), sensory deficit (31.9%) and motor deficit (12.8%) respectively. Less common was the incidence of bladder and bowel disturbance (10.6%) and of those patients, one had frank cauda equina syndrome. Only 8.5% had neurogenic claudication explicitly mentioned in their clinic notes.

Symptom	Frequency (n)	Percentage (%)
Radiculopathy	41	87.2
Back pain	37	78.7
Sensory deficit	15	31.9
Motor deficit	6	12.8
Bladder/bowel disturbance	5	10.6
Neurogenic claudication	4	8.5

Table 2: Symptoms experienced by patients prior to surgical intervention

Pre-operative MRI findings

The mean percentage of canal compromise was 23.55% ± 11.717 and values varied widely from 8-49%. Despite this, there was no significant difference in canal compromise *(t(40) = 1.082, **p = .286**)* between those who underwent fusion *(M = 25.41 ± 13.721)* and those who had decompression-alone *(M = 21.50 ± 8.930)*. Low-grade spondylolisthesis (Meyerding grade 1) was present in 15 of the 42 pre-operative MRIs available and similarly, those who had spondylolisthesis were no more likely to undergo fusion than those who had normal alignment. 9 patients with spondylolisthesis underwent fusion and 6 underwent decompression-alone. Of those 6, none required re-operation.

As facet angles vary naturally from cephalic to caudal (27, 28), angles were measured exclusively at the level of L4/5. 24 angles were recorded with a mean angle of 41.71° ± 10.929. Mohanty et al. (27) analysed the facet angles of 151 healthy adults, and, from 115 facet angles taken at L4/5, their mean was reported to be 48.32 ± 6.38. Our angles

were more sagittal in orientation and this difference is of statistical significance (*t(137) = 4.0111,* ***p = .0001***).

	Mean (°)	SD	t	(df)	P
Primary dataset	41.71	10.929	4.0111	137	0.0001*
Mohanty et al. (27)	48.32	6.380			

*Table 3: t-test comparing the mean facet angles of our dataset and that of Mohanty et al (27). * = denotes statistical significance*

82.2% of patients had an effusion in the affected facet joint, with a mean gap of 1.85mm ± 1.159.

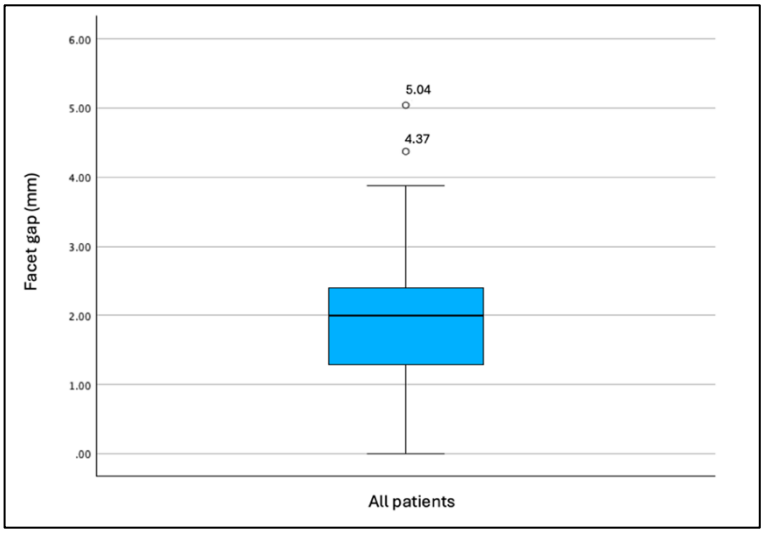

Figure 4: Boxplot illustrating the width of the 'gaps' seen in the facet joints. Measurements ≥ 1mm are thought to have an effusion (26).

Surgical management & intra-operative findings

Facet cysts occurred most commonly at L4/5 (51.1%), followed by L3/4 (17%) and L5/S1 (12.8%). Cervical and thoracic/thoracolumbar cysts were a rare finding, with

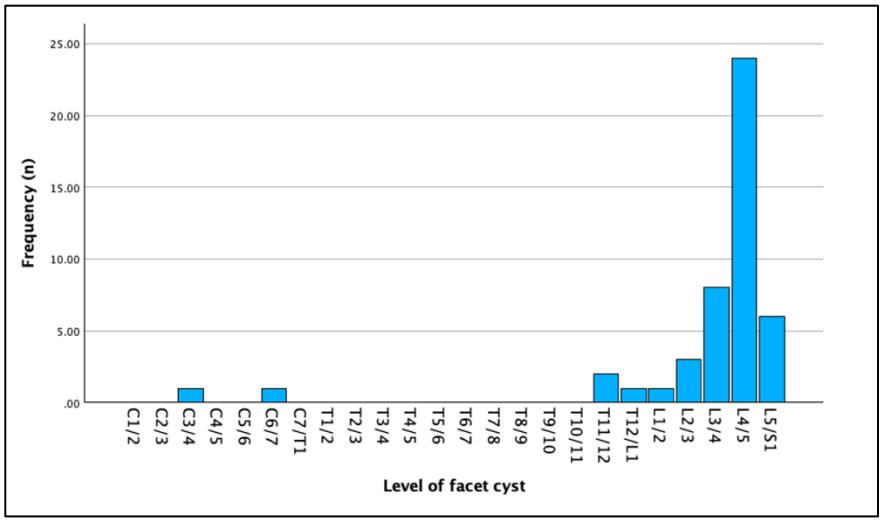

Figure 5: Bar chart demonstrating the frequency of facet cysts seen at each spinal level.

incidences of 4.2% and 6.4% respectively. There were three documented cases of bilateral cysts, all of which, developed in the lumbar region.

51% 9 (n = 24) of cases had decompression-alone and 49% (n = 23) had decompression-fusion. The vast majority of fusions were posterior-lumbar fusions (PLF) (78%). Transforaminal lumbar interbody fusion (TLIF) and posterior lumbar interbody fusion (PLIF) were used in only 13% and 9% of cases. 77% (n = 36) of cases were primary operations and 23% (n = 11) were revisions. Of these 11, 4 previously had fusions and underwent revision due to ASD. Indirect visualization was used in 70% (n= 33) of cases; surgical loupes were used in 14 cases and microscopes in 19.

	Decompression (n)	Fusion (n)	P
Total	24	23	-
Dural Tear	0	3	.070
CSF leak	0	1	.312
Blood loss (ml)			<.001*
<200	20	5	
200-500	3	11	
500–1,000	1	7	

*Table 4: One-way ANOVA test comparing the incidence of dural tears, cerebrospinal fluid leaks and volumes of blood loss intra-operatively. * = denotes statistical significance*

Complications were a rare occurrence. Over the course of 10 years, there were 3 dural tears, with one resultant CSF leak. All instances were in patients undergoing fusion. A clear trend exists between the method of decompression and intra-operative blood loss; fusion, on average, results in a greater volumes of blood loss compared to decompression-alone (p =<.001).

Post-operative outcomes & subsequent follow-up

Patients received their first follow-up at 5.32 $\pm$ 3.910 weeks on average. Of those available for follow-up (n = 44), 88.6% had a documented improvement in symptoms. 25% (n = 11) and 8% (n = 8) of patients experienced radiculopathy and back pain at this stage, a considerable improvement from 87.2% and 78.7% prior to intervention. Subsequent follow-up was carried out at 10.45 $\pm$ 10.935 months on average and by that point the rates of radiculopathy and back pain had risen to 42% and 44%. Four patients, also experiencing symptoms of pain and radiculopathy, had confounding factors - a new diagnosis of hip arthritis in three cases and myeloma in one case - and were consequently removed from this statistic. Our results show that, contrary to the findings of Benato et al. (7), the incidence of post-operative back pain and radiculopathy did not differ between those who underwent fusion and those who had decompression-alone.

Symptoms	Fusion (n)	Decompression-alone (n)	p
Total (first follow-up)	22	22	-
Radiculopathy (first follow-up)	7	4	.286
Back pain (first follow-up)	4	4	1.00
Total (subsequent follow-up)	22	21	-
Radiculopathy (subsequent follow-up)	10	8	.625

Back pain (subsequent follow-up	10	9	.864

Table 5: a Chi square proportion test demonstrated that there were no significant differences between the rates of post-operative back pain and radiculopathy between fusion and decompression-alone

5 patients required re-operation and neither case was related to a facet cyst recurrence. Two of the original decompression-group underwent fusion at a later date. In both cases, this was at the same level where decompression was initially carried out. The remaining three patients had already had spinal-fusion and required either revision-extensions (n = 2) - due to fusion-failure and difficulties with screw placement - or decompression-alone, due to the development of ASD (n = 1). One patient developed a symptomatic recurrence of their FJC over the study period and this patient had previously undergone decompression-alone. The cyst developed at L5/S1 at the same level where the decompression was performed.

	Fusion (n)	**Decompression-alone (n)**	**P**
Total (at follow-up)	22	21	-
Underwent revision	3	2	.674
Cyst recurrence	0	1	.300

Table 6: a Chi-square proportion test demonstrated that patients were no more likely to undergo revision than those receiving a decompression-fusion. One patient in the decompression-alone group developed a symptomatic recurrence of their facet cyst.

Discussion

Despite the relatively small number of patients in our study, our demographics lie much in-line with the available literature (15, 29). Patients were, on average, in late-middle-age when they underwent surgical decompression, with a gender distribution leaning slightly towards women.

A sagittal orientation in the facet joint, along with the presence of spondylolisthesis have both been linked with the development of facet joint cysts, and this supports the theory that facet cysts go hand in hand with spinal instability (13, 29). Grade 1 spondylolisthesis had a prevalence of 36% in our study and our facet angles were demonstrably more sagittal in orientation (p = .001) compared to that in healthy individuals (27). We observed that 82.2% of patients had an effusion in the affected facet joint and this, too, is thought to contribute to the pathophysiology of FJCs (30). Two studies have linked the presence of facet effusions with segmental hyper-mobility (31, 32). Unsurprisingly, cysts occurred most commonly at L4/5 (51.1%) and this is in keeping with the findings of numerous reputable works (5, 7, 17, 33). Benato et al. explains that there is a duality to this lumbar level; it is the segment which is both the most mobile and the most subject to axial stress (7).

From the above points, it is logical to deduce that decompression-fusion may offer added benefits over standalone decompression and many studies have been able to support this claim (5, 17, 33). Bydon et al. implied that decompression-alone may propagate degenerative processes and lead to further instability (17). Our findings do not support this hypothesis. Only two of the five patients in need of revision had standalone decompression. Equally important was the fact that neither of the patients

with spondylolisthesis (n = 9) required revision. Similar findings were reported by larger retrospective analyses (18, 34). Khalid et al. (18) collated post-operative data from 976 patients diagnosed with a lumbar synovial cyst and found that the revision rate for both procedures were similar. From this, it was concluded by Khalid that indicators of instability should not automatically necessitate fusion (18). Moreover, it could be said that fusion itself may also give rise to instability in the form of adjacent segment disease; fusion results in adjacent segments becoming hypermobile to account for relative lack of movement at the level restricted by fusion (20). Indeed, four of the 47 patients in our study, in fact, had previous spinal fusions and subsequently developed cysts either above or below the fused level. To the best of our knowledge, no publication to date has explored the relationship between spinal fusion and the development of facet joint cysts.

Facet cysts are reported to be more likely to recur in those who undergo decompression-alone (5, 7, 17). One patient developed a symptomatic recurrence, and this was at the same level where the cyst originally developed. While the cyst recurrence was in an individual undergoing standalone decompression, a single recurrence over a 10 year-period speaks well of this method, and it could be argued that the complication rates associated with fusion may outweigh the slight decrease in recurrence risk. Our findings were in line with that of Xu et al (5). All instances of dural tears (n = 3) and CSF leaks (n = 1) were in the fusion group and patients were more likely to experience greater volumes of intra-operative blood loss compared to decompression-alone ($p = .001$). Despite this, it is difficult to definitively answer whether fusion had a causal relationship with the development of dural tears; in all three instances, it was remarked in the operation notes that the cysts were adhered to the dura. It is therefore possible that these cysts were merely more difficult and complicated to remove, and consequently fusion was chosen in favour of decompression-alone.

Perhaps the most convincing argument in favour of decompression-fusion is the finding that patients, on average, have been shown to experience lower incidences of back pain and radiculopathy post-operatively (5, 7, 17). In a study of 167 patients, Xu et al (5) found that post-operative back pain occurred only in those who underwent standalone decompression (5%). Similarly, the incidence of post-operative radiculopathy was 12% in the decompression-alone group and 8% in decompression-fusion group. By contrast, we found that rates of post-operative back pain and radiculopathy, both at initial and subsequent follow-up, were roughly the same between the two groups. Van Dijke et al (35) observed similar results from a cohort of 45 patients. The contradictory nature of these results demonstrates that the consensus on which method is most effective in reducing post-operative symptoms, remains controversial. Nevertheless, our data points towards little to no benefit in selecting fusion over decompression-alone, which begs the question: should fusion be attempted at all when patients first present with a facet cyst in need of surgical excision?

Study limitations

As data was collated from 2014-2024, it is probable that patients receiving operations closer to 2024 were not allotted the appropriate time to develop cyst recurrence or require revision. Moreover, no post-operative MRI scans were available to establish if

those previously with spondylolisthesis had developed further slippage following decompression. As documentation notes were available on *Bluespier* from 2013 onwards, it was not possible to gather additional data from years prior. As such, our study contained a relatively small number of patients.

Conclusion

Our results suggest that decompression-alone remains a suitable choice in most patients, even in patients with radiological findings suggestive of concurrent instability. There appeared to be no particular reason why some patients underwent fusion and others underwent decompression-alone. Irrespective of this, the post-operative outcomes – rates of symptom recurrence, revision rate and cyst recurrence - remained the same. Further research is needed to explore the long-term outcomes of individuals undergoing decompression-fusion.

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