Original Study

The incidence of new onset sacroiliac joint pain following lumbar fusion

Yu Chao Lee, Robert Lee, Clare Harman

Spinal Surgery Unit, Royal National Orthopaedic Hospital, Stanmore, UK

Contributions: (I) Conception and design: YC Lee, R Lee; (II) Administrative support: All authors; (III) Provision of study materials or patients: R Lee, C Harman; (IV) Collection and assembly of data: All authors; (V) Data analysis and interpretation: YC Lee, R Lee; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: Yu Chao Lee. Royal National Orthopaedic Hospital, Stanmore, HA7 4LP, UK. Email: yuchao.lee@gmail.com.

Background: The sacroiliac joint (SIJ) can be a new source of pain following lumbar fusion. The aim of this study was to identify the incidence of and predisposing factors for new onset SIJ pain following successful lumbar fusion.

Methods: We review our series of 317 patients who underwent spinal fusion in the past 5 years to identify patients who developed new onset SIJ pain. All patients had a minimum 12 months follow up. Diagnostic criteria for SIJ pain were: New onset pain localised to lower lumbar region and buttocks, ≥2 positive provocative tests of SIJ and pain relief of >70% achieved from SIJ block.

Results: There were 38 patients who developed new SIJ pain following fusion with an overall incidence of 12.0%. The average time to new onset symptoms was 22 months. Of the 38 patients, 57.9% had fusion to sacrum. The incidence of SIJ pain in patients who had fusion extending into sacrum was 12.6% *vs*. 11.2% in those who had not. The incidence of SIJ pain was 11.1% with 1-level fusion, 12.0% with 2-level fusion, 12.9% with 3-level fusion and 14.0% with equal or more than 4-level fusion.

Conclusions: New onset SIJ pain can arise following spinal fusion. We have not found a higher frequency of SIJ pain in patients with fusion extending to sacrum or longer spinal construct.

Keywords: Sacroiliac joint (SIJ); pain; spinal fusion; lumbar fusion

Submitted May 14, 2019. Accepted for publication Jul 24, 2019.
doi: 10.21037/jss.2019.09.05
View this article at: http://dx.doi.org/10.21037/jss.2019.09.05

Introduction

Spinal fusion surgery performed in carefully selected patients with adult spinal deformity has been shown to improve clinical outcomes when attention is taken to restore spino-pelvic sagittal alignment parameters. Despite this, the frequency of failed surgery in relieving symptoms remained as high as 20–40% (1). Instead of categorically labeling this group of patients with "failed back surgery syndrome", it is important to identify possible causes for their ongoing or new onset symptoms. A potential cause might be pain originating from the sacroiliac joint (SIJ).

The SIJ forms the lowest segment of the spinal axis and is the largest axial joint in the body (2). It serves to distribute forces from the upper body to the lower limbs and is subject to large shear forces. Movement within the SIJ is minimal with previous radiostereometric analysis showing only 2.5° rotation and 0.7 mm translation from the joint (3). Despite this, SIJ and surrounding ligaments are richly innervated and even small increase in motion may trigger pain (4,5). Lumbar fusion surgery leads to increase stresses across SIJ (6). The mechanical response seen in the SIJ following spinal fusion is similar to those seen in the proximal mobile segments adjacent to a fused spine, with increase mobility and increase in stress on articular surfaces confirmed by a biomechanical study (6). The frequency of SIJ pain contributing to ongoing back pain following lumbar fusion has been reported to be between 32–42% (7-9); however the

Table 1 Baseline demographic data

Demographic data	Number
Age	56.7 (SD 12.2)
Gender	
Male	45%
Female	55%
Number of fused mobile segments	
One	135
Two	108
Three	31
Equal or more than four	43
Fusion to sacrum	
Yes	174
No	143
Diagnosis	
Degenerative spondylolisthesis	33.2%
Degenerative disc disease with stenosis	25.6%
Degenerative scoliosis with sagittal deformity	21%
Revision for non-union (primary procedure done at another institution)	8%
Lumbar disc herniation (including recurrence)	6.1%
Proximal junctional failure (primary procedure done at another institution)	4.5%
Others (fracture, infection)	1.6%

frequency of new onset sacroiliac pain following successful lumbar fusion surgery remains unknown. The purpose of this study is to identify the incidence of new onset SIJ pain following successful lumbar fusion surgery and identify possible predisposing surgical factors for new onset SIJ pain following surgery. Our hypothesis was that fusion involving the sacrum and longer spinal construct may lead to higher incidence of new onset SIJ pain following fusion.

Methods

We performed a retrospective analysis on prospectively collected data from a single surgeon case series over 5 years. All patients did not have symptomatic SIJ pain pre-surgery. Patients who underwent fusion surgery for malignancy were excluded. Patients who had iliac bolts or S2AI screws were also excluded. A combination of autologous bone graft harvested locally with osteoinductive synthetic graft were utilised for fusion in all patients and none had posterior iliac crest bone graft harvested. To investigate the true frequency of new SIJ following lumbar fusion, only patients who complained of new onset back pain of different quality following improvement of previous symptoms were considered. Patients with persistent back pain of similar nature to preoperative state were excluded as they could have a misdiagnosis of SIJ syndrome prior to lumbar fusion. Diagnostic criteria for SIJ pain used in this study was in accordance with previous published study (10): new onset of pain localised to lower lumbar region and buttocks not originating from spine or hip, at least 2 positive provocative tests of SIJ (FABER test, Thigh thrust, Iliac distraction test, Gaenslen's test) and pain relief of >70% achieved from SIJ block performed under CT guidance. To evaluate risk factors for new onset SIJ pain, information regarding the number of segments fused and whether fusion extended to sacrum were collected from all patients. All patients had a minimum follow-up of 12 months (mean 42 months, range, 12–77 months). All patients provided informed consent for their radiological and clinical data to be utilised for research purposes. The annual incidence for each given year of follow-up was calculated by dividing the number of patients who were diagnosed with new SIJ pain in that year by the number of patients who had been disease free at the start of the year.

Statistical analysis was performed using GraphPad QuickCals. Group differences (fusion levels, fusion involvement of sacrum) were assessed using Pearson's Chi square test.

Results

There were 317 patients who underwent lumbar fusion surgery included in this study after excluding those with malignancy and pelvic screws. Their baseline demographics are outlined in *Table 1*. There were 38 patients who developed new onset pain following fusion who fulfilled diagnostic criteria of new onset SIJ pain. The overall incidence of new onset SIJ pain in patients with lumbar fusion surgery was 12.0%. *Table 2* shows the characteristics of the 38 patients with new SIJ pain. The timing to new onset SIJ pain following fusion ranged from 6–48 months (mean 22 months). The annual incidence rate for developing new onset SIJ pain following lumbar fusion as shown in *Table 3*.

Table 2 Clinical characteristics of patients with sacroiliac joint pain after fusion

Demographic data	Number
Age	57.8
Gender	
Male	11
Female	27
Number of fused mobile segments	
One	15
Two	13
Three	4
Equal or more than four	6
Fusion to sacrum	
Yes	22
No	16

Table 3 Annual incidence of new SIJ pain after lumbar fusion

Years of follow-up	No. of patients	No. at risk	No. with new SIJ pain	Annual incidence (%)
1	317	317	11	3.5
2	270	265	12	4.5
3	204	199	9	4.5
4	138	130	6	4.6
5	75	69	0	0.0
6	23	22	0	0.0

SIJ, sacroiliac joint.

Of the 38 patients with newly developed SIJ pain, 57.9% had fusion extending to sacrum. However, the actual incidence of SIJ pain was only slightly higher compared to those who did not have fusions to the sacrum. The overall incidence of SIJ pain in patients who had fusion extending into sacrum was 12.6% (22 of 174 patients) as compared to 11.2% (16 of 143 patients) in those who did not. There was no statistical difference between the two groups (*Table 4*).

New onset SIJ pain developed in 15 of 135 patients with 1-level fusion (11.1%), 13 of 108 patients with 2-level fusion (12.0%), 4 of 31 patients (12.9%) with 3-level fusion and 6 of 43 patients (14.0%) with equal or more than 4-level fusion (range, 4–16 levels). No statistical difference was observed between patients who had 1-level fusion versus equal or more than 4 levels fused (*Table 5*).

Table 4 Frequency of new SIJ pain based on fusion involvement of sacrum

Fusion to sacrum	Total patients in the cohort	Patients with SIJ pain	Incidence (%)
Yes	174	22	12.6
No	143	16	11.2

Chi square test, P=0.69, not significant. SIJ, sacroiliac joint.

Table 5 Frequency of new SIJ pain based on number of fused segments

Number of fused mobile segments	Total patients in the cohort	Patients with SIJ pain	Incidence (%)
One	135	15	11.1
Two	108	13	12.0
Three	31	4	12.9
Equal or more than four	43	6	14.0

Chi square test between 1-level and 4-level, P=0.31, not significant. SIJ, sacroiliac joint.

Discussion

SIJ being a potential pain generator had been reported as early as 1905 (11), yet this condition has received relative little attention until recently. The prevalence of SIJ pain is estimated to be between 14–22% in patients referred to outpatient for evaluation of chronic back pain (12,13). A few studies had looked into the frequency of SIJ being the source of pain in patients who had persistent back pain after spinal fusion (failed back surgery syndrome). Katz *et al.* reported that SIJ was the cause of pain in 32% of patients with persistent back pain after lumbosacral fusion (8). In another study by Maigne and Planchon, 35% of patients with persistent symptoms after spinal fusion originated from the SIJ (9). However, there has been minimal data on the actual incidence of new onset SIJ pain after successful spinal fusion surgery. There had only been one study by Unoki *et al.* who looked at new onset SIJ pain in 262 patients who had lumbosacral fusion and found an incidence of 10.7% (28 out of 262 patients) (10). Our study represents the second paper in the literature with a larger patient population looking at new onset SIJ pain following lumbar fusion and we noted a comparable finding with an incidence of 12.0% (38 of 317 patients).

The mechanism in which spinal fusion leads to SIJ pain is postulated to be similar to proximal junctional degeneration

in fused spine. In a finite element study by Ivanov *et al.*, fusion in the lumbar spine increased motion and stresses at the SIJ (6). In this biomechanical study, the authors noted the longer the construct, the greater the stress generated at the SIJ (6). Previous study had shown an increased incidence (20%) of SIJ pain following 3-level spinal fusion (10). While we noted a slightly increase in incidence of SIJ pain in patients who had ≥4-level fusion compared to single level (14% *vs.* 11.1%), the increased in incidence rate was only marginal. In a radiological study by Ha *et al.*, the authors noted accelerated radiological SIJ degeneration in patients who had fusion extending to sacrum compared to those ending at L5 (14). Our findings are in line with other clinical studies (9,10) that there was no significant difference in SIJ pain in patients who had fusion extending to sacrum or than those who did not.

We applied strict inclusion and exclusion criteria to rule out potential confounding factors that may cause pain in the SIJ region; this allowed us to investigate the true incidence of SIJ pain that is due to the increase in mechanical load from lumbar fusion surgery. We excluded patients with malignancy as potential micro-metastases in the pelvis and sacrum not initially apparent on preoperative imaging may lead to subsequent pain in SIJ region. Similarly, we excluded patients who had iliac bolts screws and S2AI screws as screw head prominence can be a potential confounding factor. Posterior iliac bone graft harvesting is known to cause SIJ pain due to disruption to the inner table of the SIJ during the process; however none of our patients had this procedure. Misdiagnosis of an SIJ syndrome before spinal fusion surgery was a possibility, hence as part of our routine, we performed provocative test on the SIJ to confirm that SIJ was not symptomatic during initial consultation prior to consideration of any spinal fusion procedure. In addition, to ensure patients' symptoms represented new onset pain, we specifically questioned patients who complained of pain post-surgery to clarify amelioration of pre-surgical symptoms and obtained confirmation that symptom is indeed new.

Our strict exclusion criteria may have accounted for the difference in findings between our study and Unoki *et al.* (10). In particular, unlike our study, they have not excluded patients who had iliac bolts or S2AI screw fixations (10). Both iliac bolts and S2AI screw fixations are commonly inserted in patients requiring severe sagittal balance correction in adult spinal deformity, who also often require long fusion constructs (3 levels or more) to restore spinopelvic parameters. Therefore, without excluding patients who had iliac bolts or S2AI fixations, there is a possibility of over diagnosing SIJ pain in patients with long fusion constructs (>3 levels). Postoperative spinopelvic sagittal alignment may be another reason why some patients are more prone to develop postoperative SIJ pain and may also account for the differing findings with previous study. We routinely assess preoperative sagittal parameters and aim to achieve realignment objectives defined by Schwab *et al.* (15) for patients with adult spinal deformity. Similar to proximal junction degeneration, we believe that SIJ dysfunction and degeneration are more likely to develop if satisfactory postoperative sagittal alignment is not attained. Future studies should look into the correlation between postoperative SIJ pain and postoperative sagittal parameters to confirm this.

There is general consensus among clinicians that SIJ pain should be managed initially with non-operative measures. Our experience is generally similar and 30 of the 38 patients were successfully managed with focused rehabilitation involving core and pelvic stabilization, anti-inflammatory medication, pain management referral for counseling and radiofrequency denervation. Eight out of the 38 patients failed non-operative treatment and underwent SIJ fusion with good results.

The main limitation from our study is that we cannot rule out the possibility of delayed onset of SIJ pain. As the average time to onset of new SIJ symptoms is 22 months from our study, those who had only 12 months follow up may develop pain later. Hence our study may under predict the actual incidence of new onset SIJ after lumbar fusion.

In conclusion, new onset SIJ pain can arise following spinal fusion and it is important for spinal surgeons to identify this potential condition and treat accordingly. However, we have not found a higher frequency of SIJ pain in patients with fusion extending to the sacrum or longer spinal constructs.

Acknowledgments

None.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Ethical Statement: Ethics approval was not required for this study. Consent was obtained from all patients for their

radiological and clinical data to be collected for research purposes. The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

References

1. Thomson S. Failed back surgery syndrome - definition, epidemiology and demographics. Br J Pain 2013;7:56-9.
2. Cohen SP. Sacroiliac joint pain: a comprehensive review of anatomy, diagnosis, and treatment. Anesth Analg 2005;101:1440-53.
3. Sturesson B, Selvik G, Uden A. Movements of the sacroiliac joints. A roentgen stereophotogrammetric analysis. Spine (Phila Pa 1976) 1989;14:162-5.
4. Fortin JD, Kissling RO, O'Connor BL, et al. Sacroiliac joint innervation and pain. Am J Orthop (Belle Mead NJ) 1999;28:687-90.
5. Grob KR, Neuhuber WL, Kissling RO. Innervation of the sacroiliac joint of the human. Z Rheumatol 1995;54:117-22.
6. Ivanov AA, Kiapour A, Ebraheim NA, et al. Lumbar fusion leads to increases in angular motion and stress across sacroiliac joint: a finite element study. Spine (Phila Pa 1976) 2009;34:E162-9.
7. DePalma MJ, Ketchum JM, Saullo TR. Etiology of chronic low back pain in patients having undergone lumbar fusion. Pain Med 2011;12:732-9.
8. Katz V, Schofferman J, Reynolds J. The sacroiliac joint: a potential cause of pain after lumbar fusion to the sacrum. J Spinal Disord Tech 2003;16:96-9.
9. Maigne JY, Planchon CA. Sacroiliac joint pain after lumbar fusion. A study with anesthetic blocks. Eur Spine J 2005;14:654-8.
10. Unoki E, Abe E, Murai H, et al. Fusion of Multiple Segments Can Increase the Incidence of Sacroiliac Joint Pain After Lumbar or Lumbosacral Fusion. Spine (Phila Pa 1976) 2016;41:999-1005.
11. Goldthwait JE, Osgood RB. A Consideration of the Pelvic Articulations from an Anatomical, Pathological and Clinical Standpoint. Boston Med Surg J 1905;152:593-601.
12. Bernard TN Jr, Kirkaldy-Willis WH. Recognizing specific characteristics of nonspecific low back pain. Clin Orthop Relat Res 1987:266-80.
13. Sembrano JN, Polly DW Jr. How often is low back pain not coming from the back? Spine (Phila Pa 1976) 2009;34:E27-32.
14. Ha KY, Lee JS, Kim KW. Degeneration of sacroiliac joint after instrumented lumbar or lumbosacral fusion: a prospective cohort study over five-year follow-up. Spine (Phila Pa 1976) 2008;33:1192-8.
15. Schwab F, Patel A, Ungar B, et al. Adult spinal deformity-postoperative standing imbalance: how much can you tolerate? An overview of key parameters in assessing alignment and planning corrective surgery. Spine (Phila Pa 1976) 2010;35:2224-31.

Cite this article as: Lee YC, Lee R, Harman C. The incidence of new onset sacroiliac joint pain following lumbar fusion. J Spine Surg 2019;5(3):310-314. doi: 10.21037/jss.2019.09.05