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Original Article

Predictors and Treatment Strategy of Sacroiliac Joint Pain after Lumbar-Fixation Surgery

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BACKGROUND: Sacroiliac joint (SIJ) pain is a commonly encountered problem following spine surgery. Therefore, its accurate diagnosis and proper management is mandatory for improving the quality of life following spine surgery.

OBJECT: The aim of the study was to determine the incidence of SIJ dysfunction following lumbar fixation and to identify the possible risk factors and the treatment options.

METHODS: A prospective study was conducted on 40 patients who were subjected to lumbar fixation by transpedicular screws. We included patients undergoing surgical lumbar fixation with no preoperative sacroiliac pain, while patients who had sacroiliac pain preoperatively or after surgeries other than fixation were excluded. All cases were operated upon in Cairo University Hospitals between March 2020 and October 2020. Sacroiliac joint pain was assessed post operatively using the Visual Analogue Scale (VAS). Estimated odds ratio (OR) with 95% confidence intervals (95% CI) and p values were used to evaluate the statistical significance of the associations and correlations between variables. A p value < 0.05 was considered statistically significant.

RESULTS: Sacroiliac joint dysfunction occurred in 25 patients (62.5%). Increased body mass index (BMI), sacral fusion and multi-level fixation were regarded as important risk factors that lead to increased incidence of sacroiliac joint dysfunction post operatively (p value =0.034, 0.033 and 0.046, respectively). Eight patients were successfully managed conservatively, while 17 patients needed SIJ injection with 71% improvement.

CONCLUSION: The lumbar fixation surgery disrupts the biomechanics of the lumbar spine increasing the incidence of sacroiliac joint dysfunction. Possible risk factors include increased body mass index, sacral fusion and multilevel fixation. Conservative treatment is the initial management of choice and it is effective in several cases. Sacroiliac joint injection with methylprednisolone and local anesthetics is an important line of treatment that gives excellent temporary relief of pain.

KEYWORDS: Lumbar fusion, pain, sacroiliac joint (SIJ), spinal fusion.

INTRODUCTION

Sacroiliac pain that occurs after fixation of the lower lumbar vertebrae is a postoperative sequel, which prevents the satisfaction of the patients after surgery.[1] Association between sacroiliitis and fixation of the lower lumbar vertebrae has been recently increasingly recognized.[2–4] The patient usually complains of persistent or newly developed back pain after surgery.[5] This can be due to the increased mechanical load on the sacroiliac joint (SIJ) postoperatively, or due to a preoperative misdiagnosis of the SIJ pain as being a mechanical back pain.[1,6–8] The SIJ has to be properly examined pre operatively to avoid such a complication.[9] The SIJ range of motion in flexion-extension is about 3°, followed by axial rotation (about 1.5°), and lateral bending (about 0.8°). The sacrum of the female pelvis is wider, more uneven, less curved, and more backward tilted, compared to the male sacrum. Moreover, women exhibit higher mobility, stresses/loads, and pelvis ligament strains compared to male SIJ.[10] The joint is surrounded by strong ligaments and any minimal movement may trigger a pain. The lumbar fusion surgery produces a great stress on the SIJ biomechanics.[11] This may be emphasized by the similar phenomenon of adjacent segment disease.[12]

The aim of the study was determining the incidence of SIJ dysfunction after lumbar fixation and the identification of the possible risk factors and treatment options.

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METHODS

This was a prospective study conducted on 40 patients subjected to surgical lumbar fixation by transpedicular screws. The study included patients who were undergoing lumbar fixation procedures with no preoperative sacroiliac pain, while those who had sacroiliac pain preoperatively or following surgeries other than fixation were excluded. All cases were operated upon in Cairo University Hospitals,

between March 2020 and October 2020. Ethical committee approval for the study was obtained from the Faculty of Medicine, Cairo University.

All cases were subjected to thorough history taking, clinical examination and radiological evaluation. History taking included history of pain and pain-free intervals. Clinical examination was composed of general and local examination. Full neurological examination included presence of motor weakness, sensory affection or sphincteric disturbance. Local examination included assessment of SIJ prior to surgery. All cases were followed up clinically; immediately postoperative, at one week, 4 weeks and 3 months postoperatively to assess the SIJ using provocation tests (Patrick's test, Yeoman's test, Gillet's test, sacral thrust test and sacral sulcus tenderness). Pain was assessed by VAS.

Imaging studies were assessed preoperatively and postoperatively. Preoperative images included computed tomography (CT), magnetic resonance imaging (MRI) and plain x-ray of the lumbosacral region. Postoperative images were mainly plain x-ray of the lumbosacral region to detect bone erosions, joint space alterations, subchondral sclerosis and ankyloses. All cases were subjected to postoperative imaging immediately and at 1 month interval.

Clinical management of SIJ pain included administration of non-steroidal anti-inflammatory drugs (NSAIDs), bed rest, lumbar brace and physiotherapy for 3 weeks. If symptoms did not improve, intra-articular injection with methylprednisolone and local anesthetics was performed. We used 4 mg methylprednisolone acetate added to lidocaine in a 10 ml syringe, and the maximum amount accepted by the joint was injected.

Statistical Analysis

Microsoft excel 2013 was used for data entry and the statistical package for social science (SPSS version 24) was used for data analysis. Simple descriptive statistics, arithmetic mean and standard deviation (SD), were used for summary of normal quantitative data, median and interquartile range were used for summary of abnormal quantitative data, and frequencies were used for qualitative data.

Bivariate relationship was displayed in cross tabulations and comparison of proportions was performed using the Chi-square and Fisher's exact tests where appropriate. T-independent was used to compare normally distributed quantitative data and Mann-Whitney was used for skewed data. Multivariate logistic regression was used to evaluate the dependency of the obtained results. Estimated odds ratio (OR) with 95% confidence interval (95% CI) and p value were used to evaluate the statistical significance of the associations and correlations between variables. A p value < 0.05 was considered statistically significant.

RESULTS

The SIJ dysfunction occurred in 25 patients (62.5%) while 15 patients (37.5%) did not develop SIJ dysfunction **(Fig. 1)**. The mean age of the patients that had SIJ dysfunction after lumbar fusion surgeries was 48±8.4 years with range of (34-62) years. Male gender constituted 56% (14/25) in the positive group and 40% (6/15) in the negative group.

Among the 25 patients who developed SIJ dysfunction, 15 patients (60%) were obese, 7 patients (28%) were overweight and 3 patients (12%) were of normal BMI **(Fig. 2)**. By comparing the numerical values of BMI using Chi-square t-test, there was a statistically significant difference between the groups (p=0.034).

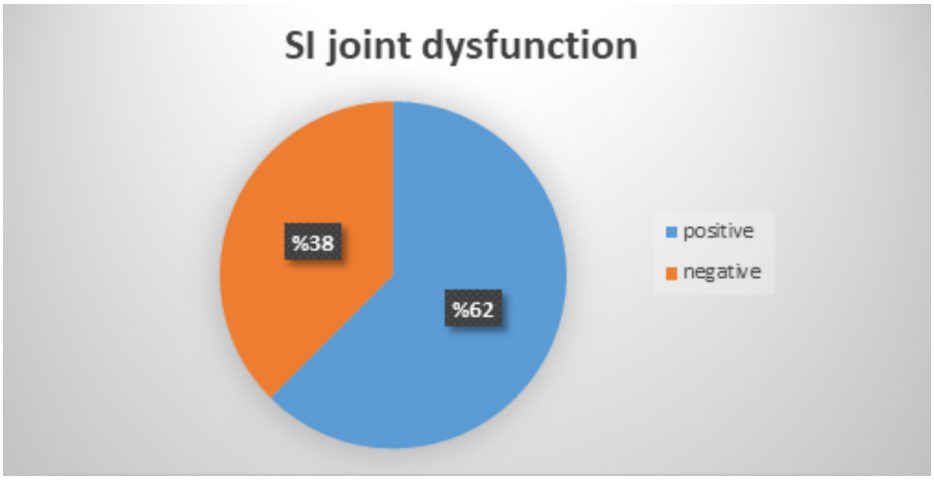

Fig 1: Incidence of SI joint dysfunction after lumbar fixation surgeries.

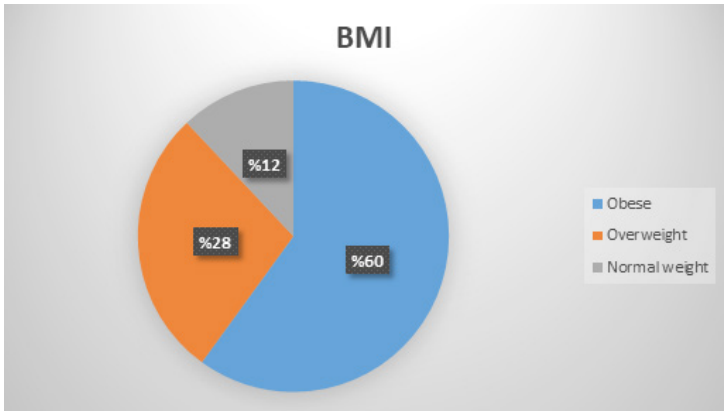

Fig 2: BMI statistics.

Twenty-five patients were operated upon by fixation of S1, 19 of these patients (76%) developed SIJ dysfunction. On the other hand, among the 15 patients who were operated upon without S1 fixation, only 6 patients (40%) developed SIJ dysfunction postoperatively **(Table 1)**. There was a statistically significant difference between the groups as regards S1 fixation (p=0.033).

Regarding multilevel fixation, 18 patients (72%) of those who developed SIJ dysfunction were operated upon by more than one level of fixation while 7 patients (28%) were operated upon by fixation of only one level, with slight statistically significant difference (p=0.046).

The most common referral patterns of SIJ pain were pain radiating to buttocks in 17 patients (68%), lower lumbar region pain in 10 patients (40%) and pain below the knee in 2 patients (8%) **(Table 2)**.

Out of the 25 patients who developed SIJ dysfunction, 8 patients (32%) improved with conservative treatment based on the visual analogue scale (VAS) while 17 patients (68%) did not improve and needed SIJ injection. Conservative management was in the form of NSAID, pelvic belt and physical therapy. These patients showed reduction in pain over time. The mean pain intensity on VAS before conservative management was 6.7 and after management was 3.5 **(Table 3)**, and this showed a statistically significant reduction of pain (p=0.001).

Regarding the 17 patients who did not improve with conservative management and needed SIJ injection, 12 patients (71%) showed reduction of pain according to VAS after injection, and 5 patients (29%) did not improve at all. The mean VAS before and after SIJ injection was 7.8 and 3.9, respectively. The SIJ injection provided a statistically significant reduction of pain in our patients (0.0015) **(Table 4).**

Table 1: Relation between sacral fusion and sacroiliac joint dysfunction

Sacroiliac joint dysfunction	Level of fixation		P value
	S1 fixation (n=25)	No S1 fixation (n=15)	
No	6 (24%)	9 (60%)	0.033
Yes	19 (76%)	6 (40%)	

n: Number, S1 : First sacra vertebra.

Table 2: Pain referral patterns in patients with sacroiliac joint dysfunction

Pain referral patterns	Sacroiliac joint dysfunction (n=25)	P value
Left sacroiliac tenderness + lower lumbar region pain referred to buttocks	4 (16%)	0.001
Right sacroiliac tenderness radiating to buttocks	6 (24%)	
Bilateral sacroiliac tenderness Radiating to buttocks + lower lumbar region pain	3 (12%)	
Left sacroiliac tenderness + lower lumbar region pain	3 (12%)	
Left sacroiliac tenderness radiating to buttocks	4 (16%)	
Right sacroiliac tenderness + pain below knee	2 (8%)	
Bilateral sacroiliac tenderness	2 (8%)	
Left sacroiliac tenderness	1 (4%)	

Table 3: Relation between mean VAS before and after conservative management

Management	VAS		P value
	Pre (n=8)	Post (n=8)	
Conservative management			
Range	5-8	2-4	0.001
Mean ±SD	6.7±1.03	3.5±0.8	

VAS: Visual analog scale, n: number, SD: standard deviation.

Table 4: Relation between mean VAS before and after SIJ injection

Management	VAS		P value
	Pre (n=17)	Post (n=17)	
Sacroiliac joint INJ			
Range	6-9	2-8	0.0015
Mean ±SD	7.8 ±0.8	3.9 ±1.7	

VAS: Visual analog scale, SIJ: Sacroiliac joint, INj: Injection, SD: Standard deviation, n: number.

DISCUSSION

There is a big discrepancy in the literature regarding the incidence of developing SIJ dysfunction following lumbar fusion surgeries. The study done by Lee et al. showed only 12% incidence of developing postoperative SIJ dysfunction, while the study by Unoki et al. reported 64% incidence of developing postoperative SIJ dysfunction. This is similar to our findings, where 62% of the cases developed postoperative SIJ dysfunction.[13,14] Colò et al. reviewed the literature and included 13 articles which showed an incidence of 37±28.5% of postoperative SIJ dysfunction out of a total of 1498 cases who did lumbar fusion surgeries.[4]

In our study, the mean age of patients that had SIJ dysfunction after lumbar fixation surgeries was 48±8.4 years. Males constituted 56% of the patients with postoperative SIJ dysfunction in our study. This was contradictory to the findings of Lee et al. who reported that out of the 38 patients who developed SIJ dysfunction, 27 were females (71%) and only 11 were males (29%) which shows a significant higher prevalence in females.[14]

It was found that BMI is an important risk factor that may lead to SIJ pain. In our study, 60% of the patients who developed SIJ dysfunction were obese (BMI 30-35), and this was similar to the study by De Palma et al. who reported that when the BMI was 30 or 35 kg/m^2, SIJ pain was most likely (46–64%).[15] A study done by Bakirci et al., which collected data from 5 observational studies all done between 2012 and 2018, concluded that the prevalence of SIJ dysfunction was much higher among obese patients than those with normal weight. This shows that obesity is a risk factor by itself, which increases the incidence of developing SIJ dysfunction.[16]

In our study, SIJ dysfunction occurred in 76% of the patients with sacral fusion and in only 40% of the patients without sacral fusion. Ha et al. reported an almost doubled prevalence of degenerative changes of the SIJ after fusion when compared with controls (75% versus 38.2%).[17] The study by De Palma et al. reported SIJ dysfunction in 58.8% of the patients with sacral fusion and in 18.2% of the patients without sacral fusion.[15] Lee et al. reported that 57% of the patients who developed SIJ degeneration post fusion had the S1 vertebra involved in the fusion.[14]

The role of the number of fusion segments remains unclear. Some authors suggest that the higher number of vertebrae involved results in higher stress forces at the adjacent segment, leading to greater risk of joint degenerative changes. However, other authors did not confirm these findings. Among our patients with SIJ dysfunction, 72% had multilevel fixation and 28% had single level fixation. Ha et al. did not find any association between the number of fused vertebrae in the lumbar spine and the SIJ dysfunction.[17] Lee et al. reported that 40% of the cases that developed SIJ degeneration had only one segment involved in the fixation.[14]

Our patients were followed up for 6 months only. Maigne and Planchon followed their patients for 3 years after lumbar fusion surgeries and found recurrence of sacroiliac pain after 6 months in 25% of the injected patients. However after second injection only 10% of the patients had recurrence of pain.[1]

Our sample size did not provide information regarding the relation between using interbody fusion and the postoperative occurrence of sacroiliitis. The use of minimally invasive percutaneous methods of fixation with minimal disruption to the spine biomechanics and their effect on postoperative SIJ dysfunction was not assessed due to the unavailability of such systems at our institute. Further assessment of the relation between interbody fusion and the development of postoperative SIJ dysfunction is recommended.

CONCLUSION

Lumbar fixation surgery disrupts the biomechanics of the

lumbar spine increasing the incidence of SIJ dysfunction. Possible risk factors include increased body mass index, sacral fusion and multilevel fixation. Conservative treatment is the first choice of treatment and it is effective in several cases. Sacroiliac joint injection with methylprednisolone and local anesthetics is an important line of treatment that gives excellent temporary relief of pain.

Abbreviations

BMI: Body mass index.
CI: Confidence interval.
CT: Computed tomography.
MRI: Magnetic resonance imaging.
N: Number.
NSAID: Non-steroidal anti-inflammatory drugs.
OR: Odds ratio.
SD: Standard deviation.
SIJ: Sacroiliac Joint.
SPSS: Statistical package for social science.
VAS: Visual Analogue Scale.

Disclosure

The authors report no conflict of interest in the materials or methods used in this study or the findings specified in this paper.

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