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Sagittal Balance After Posterior Fusion in Adolescent Idiopathic Scoliosis Versus Congenital Scoliosis

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ABSTRACT

Background Data: Although long-segment spinal fusion is well-established in achieving coronal balance in scoliotic deformities, its ability to achieve sagittal balance is variable. In some patients, the fusion needs to be extended to the sacrum/pelvis, which could be challenging.

Purpose: This study aimed to compare the sagittal balance of adolescent idiopathic scoliosis (AIS) and congenital scoliosis (CS) patients after posterior spinal fusion and to assess the effect of extending the fusion to the sacrum/pelvis on sagittal balance.

Study Design: Retrospective cohort study.

Patients and Methods: The study protocol was approved by our institution review board. All available AIS and CS patients who underwent long-segment posterior spinal fusion were included in this study. Whole spine radiographs were taken at three time points: preoperative, 2-months postoperative, and at 2-year follow-up. The spinopelvic parameters were measured in lateral views. The fusion to the sacrum/pelvis was also recorded. Comparison of the radiological parameters at the three time points between the AIS and CS patients and those with and without fusion to the sacrum/pelvis was performed.

Results: The sagittal vertical axis was significantly higher in CS patients with fusion to the sacrum/pelvis (53.4 mm postoperatively and 54.4 mm at follow-up) than in those without fusion (14.8 mm postoperatively and 11.9 mm at follow-up) and AIS patients with or without fusion to the sacrum/pelvis. In CS patients who needed fusion to the sacrum/pelvis, lumbar lordosis (LL) decreased significantly to 31° postoperatively and 34.1° at follow-up.

Conclusion: AIS patients have a better chance to achieve a normal sagittal alignment than CS patients, especially if the fusion was extended to the sacrum. Patients with CS at the lumbar region have a retroverted pelvis, which is difficult to correct by posterior spinal fusion alone, and an additional posterior osteotomy may be needed to create an adequate LL matching their pelvic incidence. Saving a distal mobile segment preserves a compensatory mechanism and decreases the incidence of postoperative sagittal malalignment. (2020ESJ219)

Keywords: Sagittal balance, fusion to the sacrum/pelvis, adolescent idiopathic scoliosis, AIS, congenital scoliosis

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INTRODUCTION

Congenital scoliosis (CS) is caused by a failure in the formation or segmentation of vertebral segments during the fourth to sixth week of development. This leads to a varying presentation, from a barely noticeable balanced deformity to a severely unbalanced kypho-scoliotic spine. CS requiring surgical treatment is usually rigid and affects both the coronal and sagittal planes.[19]
Multiple modalities have been used for the surgical treatment of CS depending on the patient's age and the severity of the deformity, including growing rods[31], VEPTR[8], hemivertebra resection with short segment fusion[4], or PVCR with long-segment fusion.[29,30]
On the other hand, adolescent idiopathic scoliosis (AIS) has no known etiology. It also has varying degrees of severity. It is usually less severe and less rigid than CS. Its surgical treatment includes growing rods if presented early[31], anterior fusion[15], and/or posterior spinal fusion (PSF) if presented late.[1,5]
Many studies proved the efficacy of PSF in correcting scoliotic deformity in the coronal plane. However, there are contradicting data regarding the sagittal balance before and after PSF in AIS and CS patients. Recently, the growing interest in studying the sagittal balance is due to the increasing use of all-pedicle screw instrumentation instead of hybrid or all-hook instrumentation.[10,24,25]
Global sagittal alignment is the net result of interacting sagittal spino-pelvic parameters.[12,14]
A change in one parameter is associated with a change in another to achieve sagittal balance.[28]
Extending the fusion to the sacrum/pelvis has been reported to lead to a higher incidence of positive sagittal balance in adult patients with spinal deformities.[11] This has been attributed to the loss of the reciprocal change in lumbar lordosis (LL) in response to the change in thoracic kyphosis.[26,35]
However, little is known about the sagittal balance in younger patients after corrective surgeries necessitating fusion down to the sacrum. In our center, the occurrence of sagittal imbalance was noticed after a long-segment fusion in many cases. To understand this and to avoid the occurrence of postoperative sagittal imbalance, we have retrospectively reviewed and analyzed our series and compared between AIS and CS patients. To the best of our knowledge, there is no published literature comparing the effect of PSF on sagittal balance between AIS and CS. Moreover, we could not find any literature comparing the effect of fusion to the sacrum/pelvis on sagittal balance in AIS and CS.
The study aimed to compare the sagittal balance of AIS and CS patients after PSF and to assess the effect of extending the fusion to the sacrum/pelvis on sagittal balance.

PATIENTS AND METHODS

This was a retrospective study of a prospectively collected single-surgeon case series in a tertiary care center. The study protocol was approved by the Ethical Committee of our institution (IRB number 17200524). The medical records and radiographs of all patients who underwent long-segment PSF for the treatment of AIS and CS from January 2014 to December 2018 were reviewed. All patients with a complete set of whole spine radiographs showing the spine from the skull to the pelvis at preoperative, 2-month postoperative, and 2-year postoperative time points were included. Any patient with paralytic disorder or inability to stand upright were excluded.
The patients were divided into two groups: AIS and CS. Each group has been divided into two subgroups according to the fusion to the sacrum. Extending the fusion to the sacrum is rarely needed in AIS cases. However, in the presence of high L5 coronal tilt angle (the angle between the line connecting the middle point of the two pedicles of L5 and the line connecting the highest point of the bilateral iliac crests), the occurrence of postoperative trunk shift is common.[27,36]
Therefore, the fusion was extended distal to L5 to correct this tilt in an attempt to avoid trunk

shift. All patients were formally consented before submission to their chosen surgical maneuvers.

Two experienced spine surgeons measured the sagittal spinopelvic parameters, and the mean values were used in the study. These parameters included: thoracic kyphosis (TK: the sagittal Cobb angle between the upper end-plate of T4 and lower end-plate of T12), LL (the sagittal Cobb angle between the upper end-plate of L1 and upper end-plate of S1), sagittal vertical axis (SVA: the distance between a plumb line dropped from C7 measured horizontally to the posterosuperior corner of the sacrum in millimeters), pelvic incidence (PI: the angle between the line perpendicular to the sacral plate at its midpoint and the line connecting this point to the axis of the femoral heads), pelvic tilt (PT: the angle between the vertical line crossing the axis of the femoral heads and the line connecting it and the midpoint of the upper end-plate of S1), and sacral slope (SS: the angle between the upper end-plate of S1 and the horizontal). Moreover, the upper instrumented vertebra (UIV), lower instrumented vertebra (LIV), proximal junctional angle (PJA: the angle between lower end-plate of UIV and the upper end-plate of the two vertebrae above), and fusion to the sacrum were recorded.

Statistical Analysis:

The statistical analysis was performed using the SPSS 20 software. The radiological parameters of the two groups at three time points (preoperatively, 2-month postoperatively, and 2-year follow-up) were compared using repeated measures ANOVA and univariate analysis. P value < 0.05 indicated the statistical significance.

RESULTS

This study included 37 AIS patients (14 males, 23 females) and 31 CS, patients (10 males, 21 females). Table 1 shows the demographic data of the patients. The mean age for all patients was 16 ± 6.1 years (range: 4–35). Among the 37 AIS patients, 31 patients were Lenke type 1 A N, five patients were Lenke type 6 C N, and one patient was Lenke type 5 C N. Among the 31 CS patients, 24 patients had unsegmented bar in the thoracic spine, four of them had associated diastematomyelia type 2 with bony septum, four patients had hemivertebra at T12, and three patients had hemivertebra at L5. The mean coronal thoracic Cobb angle was 53.86° ± 2.99° in the AIS group and 44.13° ± 3.58° in the CS group. The mean coronal thoracolumbar/lumbar Cobb angle was 34.86° ± 2.58° in the AIS group and 29.97° ± 2.37° in the CS group. The mean number of instrumented vertebrae was 13.4 ± 2.5 (range: 7–18) in the AIS group and 11.8 ± 4.2 (range: 4–17) in the CS group. The fusion was extended to the sacrum in all Lenke type 5 and 6 AIS patients (six patients) and in seven CS patients. The UIV and LIV regions and preoperative radiological parameters are shown in Table 1.

The comparison between the two groups confirmed the insignificant difference in the demographic data of patients, except for age and UIV region. The CS patients were operated at a younger age, reflecting the nature of the pathology (p =.001). Moreover, most of AIS cases had UIV in the upper thoracic region (35/37), while only two thirds of the CS patients had UIV at the upper thoracic regions (p = 0.031).

Based on the repeated measures ANOVA, SVA, PT, SS, TK, and LL (Table 2) were not significantly different at the three time points. However, the univariate analysis of the effect of "fusion to the sacrum/pelvis" shows the significantly increased SVA in patients with fusion to the sacrum (p = 0.023). PT was significantly higher in patients who needed fusion to the sacrum in all occasions (preop, postop, and at FU) (p = 0.001), while the CS patients who needed fusion to the sacrum/pelvis had a lower SS, which decreased significantly at postop (p = 0.027). There was a significant increase in the TK of CS patients with fusion to the sacrum (p = 0.011). Table 3 highlights the important demographic and radiographic data of the 13 patients who developed postoperative sagittal imbalance after PSF to the sacrum. Examples of some of our reported patients are illustrated in (Figures 1, 2, 3, and 4).

Table 1. Demographic data

Parameters		AIS (N = 37)	CS (N = 31)	P value
Gender	Male	14	10	0.412
	Female	23	21	
Age	Mean ± SD	18.2 ± 5.6 yrs	13.6 ± 5.7 yrs	0.001*
	Range	12–35 yrs	4–32 yrs	
Types		Lenke 1 A N (n = 31)	Unsegmented bar in the thoracic spine (n = 20)	
		Lenke 6 C N (n = 5)	Unsegmented bar associated with diastematomyelia type 2 with bony septum (n = 4)	
		Lenke 5 C N (n = 1)	Hemivertebra at D12 (n = 4)	
			Hemivertebra at L5 (n = 3)	
Preoperative Thoracic Coronal Cobb Angle		53.9° ± 18.2°	44.1° ± 19.9°	0.039
Preoperative Thoracolumbar/ lumbar Coronal Cobb Angle		34.9° ± 15.7°	29.9° ± 13.2°	0.174
Number of instrumented vertebrae	Mean ± SD	13.4 ± 2.5	11.8 ± 4.2	0.069
	Range	7–18	4–17	
UIV region	Upper thoracic (T1–T5)	35	22	0.031*
	Lower thoracic (T8–11)	1	4	
	Thoracolumbar (T12–L2)	1	5	
LIV region	Lower thoracic (T8–T11)	0	1	0.623
	Thoracolumbar (T12–L2)	3	2	
	Lumbar (L3–L5)	28	21	
	Fused to the sacrum/pelvis	6	7	
Preoperative SVA		4.7 ± 29.5 mm	6.7 ± 28.7 mm	0.777
Preoperative TK		42.9° ± 19.7°	34.9° ± 27.4°	0.183
Preoperative LL		54.8° ± 16.3°	57.5° ± 19.5°	0.537
Preoperative PI		46.3° ± 8.7°	46° ± 17.6°	0.923
Preoperative PT		8.5° ± 6.5°	11.9° ± 11.8°	0.150
Preoperative SS		37.9° ± 8.5°	34.1° ± 14.7°	0.184
Preoperative PJA		8.1° ± 4.3°	8.0° ± 5.4°	0.935

SVA: Sagittal Vertical Axis, PJA: Proximal Junctional Angle, SS: Sacral Slope, PT: Pelvic Tilt , PI: Pelvic Incidence, LL: Lumbar Lordosis, TK: Thoracic Kyphosis, LIV: Lower Instrumented Vertebra, UIV: Upper Instrumented Vertebra

Table 2. Preoperative, postoperative, and 2-year follow-up radiological parameters of the AIS and CS groups

Parameters	Diagnosis	Fusion to sacrum	Preoperative Mean ± SD	Postoperative Mean ± SD	Follow up Mean ± SD	P value
SVA	AIS	Not Fused	2.9 ± 31.6	10.5 ± 44.9	−1.8 ± 53.0	.023*
		Fused	14.2 ± 12.8	21.1 ± 30.3	33.2 ± 46.9	
	Congenital	Not Fused	4.1 ± 15.6	14.8 ± 45.0	11.9 ± 46.6	
		Fused	**15.9 ± 18.4**	**53.4 ± 61.**8	**54.4 ± 65.**8	
PT	AIS	Not Fused	8.1 ± 6.5	10.5 ± 9.1	8.9 ± 10.1	.001**
		Fused	10.5 ± 6.4	14.7 ± 14.3	12.0 ± 9.5	
	Congenital	Not Fused	8.6 ± 9.4	6.6 ± 15.8	8.0 ± 12.3	
		Fused	**23.6 ± 12.4**	**25.3 ± 12.3***	**25.3 ± 11.**6	
SS	AIS	Not Fused	37.9 ± 9.0	34.9 ± 8.9	36.8 ± 10.8	.027**
		Fused	38.2 ± 6.1	34.0 ± 8.2	36.2 ± 5.8	
	Congenital	Not Fused	35.9 ± 6.8	38.5 ± 14.6	37.4 ± 13.9	
		Fused	**27.7 ± 29.1**	**19.0 ± 18.**8	**22.3 ± 18.**5	
TK	AIS	Not Fused	44.5 ± 21.0	32.6 ± 15.9	33.6 ± 15.2	.011**
		Fused	34.5 ± 7.2	27.0 ± 16.2	26.9 ± 17.8	
	Congenital	Not Fused	42.4 ± 23.1	31.6 ± 19.0	33.3 ± 18.3	
		Fused	**9.3 ± 26.5**	**20.6 ± 27.4**	**25.3 ± 23.8**	
LL	AIS	Not Fused	57.0 ± 16.9	49.6 ± 14.9	52.4 ± 15.4	.002**
		Fused	43.3 ± 4.1	40.8 ± 11.4	43.4 ± 6.6	
	Congenital	Not Fused	60.7 ± 17.9	52. ± 20.1	53.5 ± 17.4	
		Fused	**46.4 ± 22.4**	**31.0 ± 20.3**	**34.1 ± 18.3**	
PJA	AIS	Not Fused	8.2 ± 4.5	12.9 ± 15.3	14.6 ± 15.4	.856***
		Fused	7.8 ± 2.6	9.4 ± 6.9	8.5 ± 7.9	
	Congenital	Not Fused	8.6 ± 5.5	8.2 ± 12.0	10.6 ± 13.5	
		Fused	6.9 ± 5.2	17.0 ± 18.6	10.0 ± 10.8	

SVA: Sagittal Vertical Axis, PJA: Proximal Junctional Angle, SS: Sacral Slope, PT: Pelvic Tilt , PI: Pelvic Incidence, LL: Lumbar Lordosis, TK: Thoracic Kyphosis, LIV: Lower Instrumented Vertebra, UIV: Upper Instrumented Vertebra

*Significant regarding fusion to the sacrum in both groups

**Significant only in CS which was fused to the sacrum

***Insignificant

Table 3. Demographic and radiographic data of the 13 patients who developed sagittal imbalance after PSF to the sacrum.

Patient ID		9	13	19	25	42	44	67	69	85	91	92	97	103
Gender		M	M	M	F	F	F	F	F	F	F	F	F	F
Age		14	14	33	15	4	8	13	25	32	11	14	15	15
Diagnosis		AIS	AIS	AIS	CS	CS	CS	CS	AIS	CS	CS	AIS	CS	AIS
Number of instrumented vertebrae		8	18	17	5	16	17	11	18	10	16	17	17	17
UIV		T11	T2	T3	L3	T3	T3	T8	T2	T10	T4	T2	T3	T3
LIV		S1	S2	S2	S2	S1	S2	S1	S2	S2	S2	S1	S2	S2
Thoracic Cobb	Preop.	20	30	43	14	25	25	10	49	10	26	29	25	45
	Postop.	10	15	1	7	6	11	7	50	2	19	22	11	19
	FU	12	14	2	10	5	10	6	47	2	20	20	13	22
Preop. TL/L Cobb	Preop.	47	66	68	50	40	44	40	70	57	45	55	55	60
	Postop.	23	10	2	17	8	8	7	27	4	30	0	17	9
	FU	23	12	2	14	8	10	3	25	8	32	1	20	5
L5 Coronal Tilt (Preop.)		20	23	26	20	20	23	10	22	54	23	19	25	23
Proximal Junctional Angle	Preop.	10	10	9	15	0	12	4	8	3	7	7	7	3
	Postop.	21.3	11.2	9	52	5	34	4	2	9	7	10	8	3
	FU	22	12	3	9	5	34	4	1	4	6	10	8	3
Sagittal Vertical Axis	Preop.	20	30	10	24	41	20	−15	25	26	15	0	0	0
	Postop.	41.3	48.4	15.1	103	42	29	107	50	124	19	−8	−50	−20.5
	FU	40	50	77.3	107	43	29	94	79	106	80	−13	−78	−34
Pelvic Incidence	Preop.	40	33	64	117	31	44	23	60	59	45	50	40	45
	Postop.	38	35	65	52	46	44	22	60	60	45	50	40	44
	FU	40	35	62	53	15	45	23	61	60	44	49	39	42
Pelvic Tilt	Preop.	8	3	20	41	31	15	37	15	17	12	12	12	5
	Postop.	12	5	40	36	20	15	43	20	28	28	12	7	−1
	FU	12	5	25	31	28	15	40	21	35	21	9	7	0
Sacral Slope	Preop.	32	30	44	76	0	29	−14	45	42	33	38	28	40
	Postop.	26	30	25	16	26	29	−21	40	32	18	38	33	45
	FU	28	30	37	22	41	30	−17	40	25	23	40	32	42
Thoracic Kyphosis	Preop.	45	32	35	−16	35	35	−35	30	6	15	25	25	40
	Postop.	58.4	26.9	26.73	−17	12	26	73	16	28	12	16	10	18
	FU	60	28	30.4	1	12	30	73	13	30	23	14	8	16
Lumbar Lordosis	Preop.	40	40	40	61	36	50	79	45	35	9	45	55	50
	Postop.	40.7	38.6	25.7	13	63	34	23	35	29	5	45	50	60
	FU	40	40	44.3	12	66	34	26	35	30	21	47	50	54

Preop: Preoperative, Postop: Post-operative, FU: Follow-up, SVA: Sagittal Vertical Axis, PJA: Proximal Junctional Angle, SS: Sacral Slope, PT: Pelvic Tilt, PI: Pelvic Incidence, LL: Lumbar Lordosis, TK: Thoracic Kyphosis, LIV: Lower Instrumented Vertebra, UIV: Upper Instrumented Vertebra

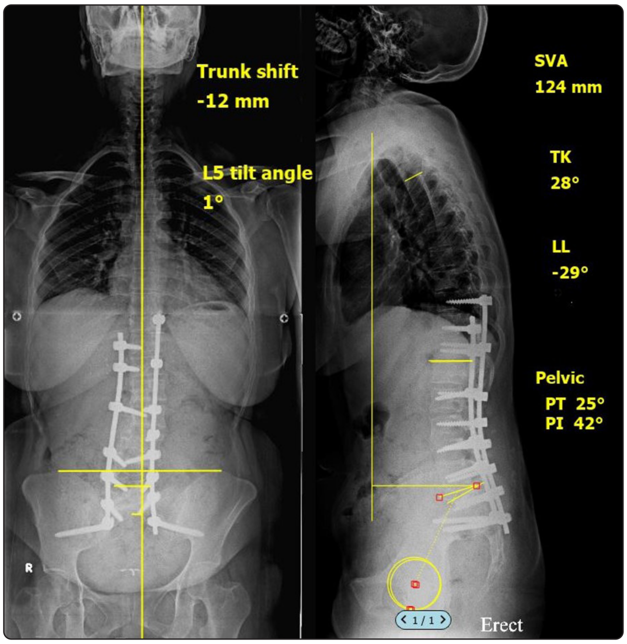

Figure 1. Patient with CS fused to the sacrum/pelvis with a positive sagittal balance (SVA = 124 mm, TK = 28°, LL = −29, PI = 42°, PT = 25°, SS = 17°, Trunk shift = 12 mm, L5 tilt angle = 1°).

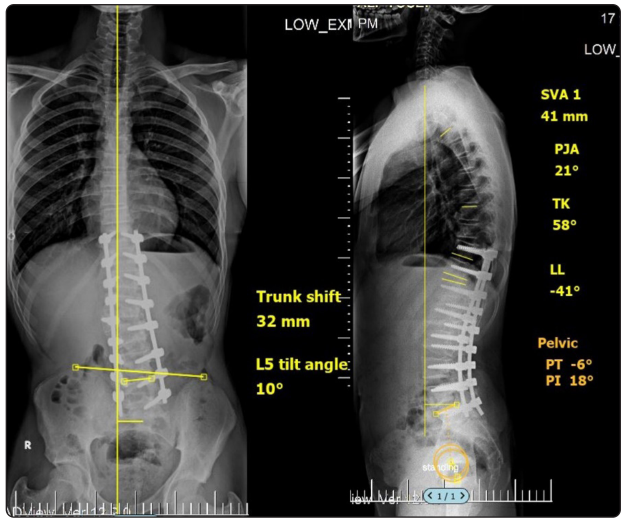

Figure 2. Patient with CS fused to the sacrum with a good sagittal balance (SVA = 41 mm, TK = 58°, LL = −41°, PI = 18°, PT = −6°, SS = 24°, trunk shift = 32 mm, L5 tilt angle = 10°).

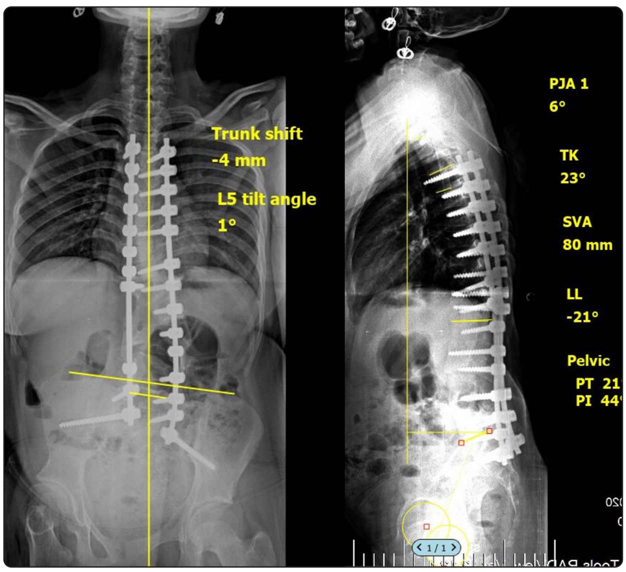

Figure 3. Patient with CS fused to the sacrum with a positive sagittal balance (SVA = 80 mm, TK = 23°, LL = −21, Pi = 44°, PT = 21°, SS = 23°, Trunk shift = 4 mm, L5 tilt angle = 1°).

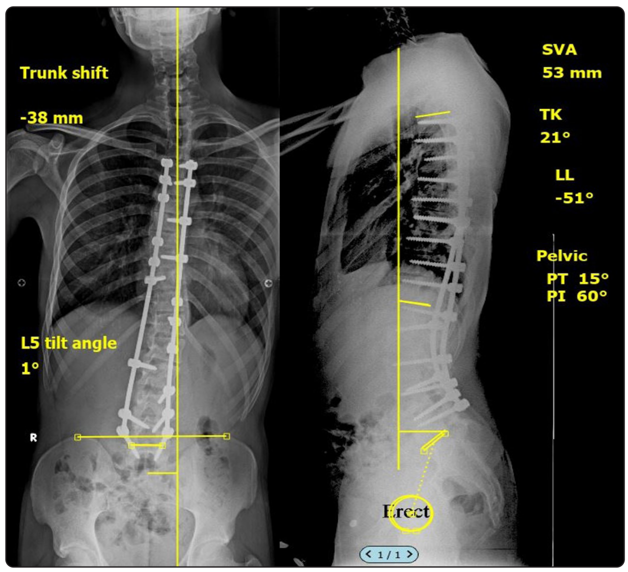

Figure 4. Patient with AIS not fused to the sacrum with an acceptable sagittal balance (SVA = 53°, TK = 21°, LL = 51°, PI = 60°, PT = 15°, SS = 45°, Trunk shift = 38 mm, L5 tilt angle = 1°).

DISCUSSION

Long-segment PSF has a great ability to correct scoliotic deformities. Achieving the correction of the coronal plane has been established; however, the effect on sagittal plane needs further attention. In our practice, we noticed the occurrence of sagittal imbalance after long-segment fusion in many cases; therefore, we reviewed our series and compared the sagittal balance of AIS and CS patients after PSF in a trial to assess the effect of extending the fusion to the sacrum/pelvis on sagittal balance. It should be noted that sparing the lumbosacral junction is much preferable, and primary fusion to the sacrum in AIS and CS is very rarely practiced[2,3,16,33,,29,30]. Nevertheless, 13 patients (19%) in this series had significant deformities that mandated the extension of the fusion to the sacrum: six AIS patients with structural thoraco-lumbar/lumbar curve (Lenke types 5 and 6) and seven CS.

The fusion to the sacrum/pelvis was reported to improve the correction[32], maintain/restore the sagittal balance, and avoid the distal adding on[6,9]. However, in this study, there was a significantly higher incidence (8/13 patient) of postoperative positive sagittal balance when the fusion was extended to the sacrum/pelvis, particularly in CS. Although the preoperative SVA, which is a measure of the global sagittal alignment[29], was comparable in all the groups and subgroups in this series, the postoperative and follow-up SVA was significantly increased in CS patients with fusion to the sacrum (53.4 ± 61.8 mm and 54.4 ± 65.8 mm) when compared to those without fusion (14.8 ± 45 mm and 11.9 ± 46.6 mm) or AIS patients with or without fusion to the sacrum (Table 2).

Furthermore, the mean postoperative and follow-up LL in CS (31° and 34.1°) was significantly less than in AIS (40.8° and 43.4°). This can be explained by the fact that the CS curves tend to be stiffer than the AIS curves and are more challenging to be reshaped in appropriate lordosis angle that matches the patients' PI. A PI–LL mismatch is known to lead to a positive sagittal balance and global sagittal malalignment, predisposes to proximal junctional kyphosis and adjacent segment degeneration.[26] On the other hand, a good sagittal balance was achieved in AIS and CS patients, with no significant difference in the postoperative and follow-up sagittal balance between AIS and CS when the fusion was not extended to the sacrum/pelvis; this is consistent with published literature.[17,18,7,23,34] Most surgeons tend to give a homogenous lordosis of the rods in the lumbar spine. According to Yilgor et al.[37], 50%–80% of the LL exists at the lower 2 levels. More recently, Le Huec et al.[13] in 2016 and Park et al.[20,21] in 2020 stressed the importance of increasing the LL in the lower 2 segments. It should be noted that LL did not decrease in the AIS and CS groups not fused to the sacrum. This also highlights the importance of the compensatory mechanism inherent in the mobile lumbar spine distal to the fusion segments.[28] PT, which describes the rotation of the pelvis around the bicoxo-femoral axis[14], acts as a distal-most mechanism to achieve sagittal balance.[22] In this series, the pelvis was found to be retroverted only in the CS patients with fusion to the sacrum (Table 2). This group was also under-corrected based on the postoperative and follow-up assessment (25.3° ± 12.3° and 25.3° ± 11.6°, respectively). The pelvic retroversion caused a subsequent significant decrease in SS (19° ± 18.8° and 22.3° ± 18.5°, respectively) only in CS patients with fusion to the sacrum/pelvis ($P = 0.027$).

The limitation of this study includes the small number of patients. However, given the fact that the primary fusion to the sacrum in AIS and CS patients was rarely reported in the literature and that this the first report that compares the sagittal balance of AIS and CS patients and the first study to address the effect of the fusion on their postoperative sagittal balance, the number of cases included is justifiable. Furthermore, because this is a single-surgeon series with a consistent operative technique and a minimum of two years of follow-up, comparing the groups and drawing conclusions are more robust.

Despite all the efforts during surgery to restore a good LL, the postoperative LL was disappointingly under-corrected in the CS group fused to the sacrum/pelvis. This may be explained by the nature of the pathology and the stiffer curves in CS. This calls for more attention from surgeons to create a significant LL that matches the PI, and this warrants an additional posterior osteotomy, anterior column support, and/or additional rods to create a stiffer construct, particularly when the fusion to the sacrum is mandated in CS.

CONCLUSION

AIS patients have a better chance in achieving a normal sagittal alignment than CS patients, particularly if fusion was extended to the sacrum. Patients with CS at the lumbar region have a retroverted pelvis which is difficult to correct by PSF alone and may need performing an additional posterior osteotomy to create an adequate LL matching their PI. Saving a distal mobile segment preserves a compensatory mechanism and decreases the incidence of postoperative sagittal malalignment.

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الملخص العربي

التوازن الأمامي – خلفي بعد جراحة التثبيت الخلفى في جنف المراهقين مجهول السبب و الجنف الخلقي

البيانات الخلفية: على الرغم من قدرة التثبيت الطويل للعمود الفقري من تحقيق التوازن في المستوى التاجي في حالات الجنف إلا أن قدرته على تحقيق التوازن الأمامي خلفي متنوعة. بعض المرضى يحتاجون امتداد التثبيت للفقرات العجزية أو الحوض مما يشكل تحديا إضافيا. على ما يبدو أن الجنف مجهول السبب في المراهقين يكون أكثر مرونة من الجنف الخلقي

الغرض: مقارنة التوازن الأمامي – خلفي بعد جراحة التثبيت الخلفى في جنف المراهقين مجهول السبب و الجنف الخلقي و تقييم تأثير التثبيت للفقرات العجزية أو الحوض على هذا التوازن كعامل مؤثر

تصميم الدراسة: دراسة قطيع بأثر رجعي

المرضى و الطرق: كل المرضى المتاحين من ذوى جنف المراهقين مجهول السبب أو الجنف الخلقى و الذين أجروا تثبيتا خلفيا طويلا تم ضمهم للدراسة. تم إجراء أشعة سينية على كامل العمود الفقري في ثلاث نقاط زمنية: قبل الجراحة و بعدها بشهرين و بعدها بسنتين. تم تسجيل حالات التثبيت للفقرات العجزية أو الحوض و وضعها في مجموعة ثانوية خاصة. تم مقارنة المجموعتين الرئيسيتين و كذلك المجموعات الثانوية فيما يتعلق بقياسات الأشعة في النقاط الزمنية الثلاث.

النتائج: التثبيت إلى الفقرات العجزية أو الحوض ارتبط بزيادة المحور الرأسي في المستوى الأمامي خلفي في الجنف الخلقى عنه في جنف المراهقين مجهول السبب و ميلان الحوض كان أكثر في الجنف الخلقى الذى تم تثبيته للفقرات العجزية أو الحوض كما كان انحدار العجز أقل. فى حالات الجنف الخلقى كان التحدب الظهرى و التقوس القطني أقل خصوصا في الحالات التي احتاجت التثبيت للفقرات العجزية أو الحوض.

الخلاصه: عدم القدرة على تحقيق التقوس القطنى المثالى يؤدى إلى عدم الاتزان في المستوى الأمامى خلفي. مرضى جنف المراهقين مجهول السبب لديهم فرصة أحسن لتحقيق هذا الاتزان من مرضى الجنف الخلقي. مرضى الجنف الخلقى في منطقة الفقرات القطنية لديهم انقلاب الحوض للخلف مما قد يمثل صعوبة في تحقيق التوازن بواسطة التثبيت الخلفي فقط و قد يستلزم إجراء شق عظمي لعنق الفقرة لتحقيق التقوس القطنى المثالى الموائم لسقوط الحوض