ORTHOPAEDICS

# ADULT SPINAL DEFORMITY SURGERY UNDERSTANDING THE TRUE IMPACT ON SPECIFIC ACTIVITIES OF DAILY LIVING

http://www.lebanesemedicaljournal.org/articles/66-4/original2.pdf

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Kieser D, Boissière L, Ghailane S, Larrieu D, Bourghli A, Yilgor C, Alanay A, Pelissé F, Sanchez Perez Grueso FJ, Kleinstück F, Acaroglu E, Yoshida G, Gille O, Vital JM, Obeid I, European Spine Study Group. Adult spinal deformity surgery: Understanding the true impact on specific activities of daily living. J Med Liban 2018 ; 66 (4) : 193-196.

**ABSTRACT • Hypothesis** : Oswestry Disability Index (ODI) globally improves after spinopelvic fusion for adult spinal deformity (ASD), but some ODI domains do not improve. **Design** : Retrospective analysis of prospective data including operated patients from a multicenter database with a 2-year follow-up. **Introduction** : Posterior instrumented fusion is a successful treatment to improve quality of life in patients disabled by ASD. Most patients are satisfied with these procedures, but the benefits to specific activities of daily living remains unclear. Therefore, the aim of this study is to evaluate the impact of spinopelvic fusions on each ODI domain. **Materials and Methods** : A total of 45 consecutive patients were enrolled. Inclusion criteria were spinopelvic fusion with the upper instrumented vertebra (UIV) between T8 to T12. Mean differences, between preoperative and the 2-year follow-up, for each ODI domain were compared with a *t*-test, and $p < 0.05$ was considered significant. **Results** : Global ODI significantly improved after surgery (52.0 *vs.* 38.5 ; $p = 0.001$). Large (more than 1 point) improvements were observed for pain and sexual life, moderate (between 0.5 and 1 point) improvements were observed for walking, sitting, standing, social life and traveling, limited (less than 0.2) improvements were observed for personal care, lifting and sleeping. **Discussion** : Spinopelvic fusion reduces the overall level of disability in patients with ASD. Specifically, it provides a large improvement in pain and sexual function, a moderate improvement in walking, sitting, standing, social life and traveling and a limited improvement in sleeping, personal care and lifting. This information should be used to fully inform patients of the specific benefits provided by spinopelvic fusion in ASD.

Keywords : adult spinal deformity; ODI; quality of life; function; activities of daily living

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**RÉSUMÉ • Hypothèse** : L'Oswestry Disability Index (ODI) est amélioré après les arthrodèses lombo-pelviennes dans les déformations rachidiennes de l'adulte, mais certains sous-domaines ne le sont pas. **Design** : Analyse rétrospective d'une base de données multicentrique avec un suivi post-opératoire de 2 ans. **Introduction** : L'arthrodèse lombo-pelvienne par voie postérieure est un traitement efficace pour améliorer la qualité de vie des patients. La plupart des patients en sont satisfaits mais le bénéfice sur certaines activités spécifiques demeure mal étudié. L'objectif de cette étude est d'évaluer l'impact des fusions lombo-pelviennes sur chaque sous-domaine du score d'Oswestry. **Matériels et Méthodes** : 45 patients ont été inclus consécutivement. Les critères d'inclusion étaient les patients opérés avec un niveau limite supérieur d'arthrodèse compris entre T8 et T12 et un niveau inférieur comprenant le pelvis. Les différences moyennes entre le pré- et le postopératoire ont été évaluées pour chaque sous-domaine de l'ODI avec un *t*-test. Un $p < 0,05$ était considéré comme significatif. **Résultats** : L'ODI était significativement amélioré par la chirurgie (52,0 *vs.* 38,5 ; $p = 0,001$). Une amélioration notable (plus de 1 point) a été observée pour l'activité sexuelle ; une amélioration modérée (entre 0,5 et 1 point) pour la marche, la position assise, la position debout, la vie sociale et le transport ; une amélioration limitée (< 0,2 point) pour la toilette, le port de charge et le sommeil. **Discussion** : Les patients présentent une amélioration globale du score d'Oswestry avec les fixations lombo-pelviennes mais cette amélioration est inégale selon le sous-domaine concerné. Cette information est importante à signaler au patient avant la chirurgie pour qu'il en comprenne bien les conséquences.

Mots-clés : déformation rachidienne de l'adulte; qualité de vie; score d'Oswestry; fonction; activités journalières

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## INTRODUCTION

Spinal conditions are some of the most common health conditions affecting adults [1]. Adult spinal deformity (ASD) includes a multitude of underlying spinal conditions, predominantly idiopathic and degenerative, characterized by spinal malalignment [2]. The exact incidence of ASD is unclear, but most are diagnosed around the age of 70 years, where the incidence has been quoted at 68% [3].

ASD can be a severe condition with an imbalanced spine functionally debilitating patients and causing poor quality of life [3-5]. Since Glassman's correlation between the Oswestry Disability Index (ODI) and sagittal vertical axis (SVA) [6], the use of health-related quality of life scores (HRQLs) to assess the success of treatments in ASD has become imperative. Many HRQLs have been described to evaluate disability including the ODI [7], SRS-22 [8] and SF-36 [9].

The ODI was initially described to evaluate low back pain and is not specifically dedicated to ASD evaluation [7]. However, it remains widely used to evaluate the response to surgical intervention with this condition. It is a questionnaire that gives a subjective score of the level of disability in activities of daily living (ADL). This index assesses a number of domains, notably pain, personal care, lifting, walking, sitting, standing, sleeping, sexual life, social life and traveling [7].

For each domain a total possible score of 5 is achievable with zero being no disability and 5 being severe disability. The scores for each domain are summed and an overall percentage of disability is calculated. This value is the most commonly reported value in the literature. However, within each domain the degree of disability can be characterized and used to assess the value of an intervention on a specific function. A mean change of more than half a point within a domain is believed to reflect a clinically significant change [7]. In contrast, a mean change of less than 0.2 is believed to be clinically insignificant.

Despite the benefit of ASD surgery on patient outcomes and satisfaction, patients increasingly require information on the effect on specific functional activities in order to make informed decisions and avoid inaccurate patient expectations [10]. To date, spinopelvic fusion has been associated with excellent patient satisfaction and improvements in overall ODI [10]. However, a clear understanding of the benefits on specific ADLs remains unclear, particularly whether the stiffening effect of the fusion induces other forms of disability.

Thus, the purpose of this study is to evaluate the changes in each domain of the ODI following spinopelvic fusion in patients with ASD.

## MATERIALS AND METHODS

We performed a multicenter study of prospectively gathered data on ASD patients, from six spine centers. Institutional review board approval was obtained at each site for patient enrolment and data collection. Inclusion criteria were patients presenting with at least one criterion: Cobb angle ≥ 20°; SVA ≥ 5 cm; thoracic kyphosis ≥ 60° or pelcic tilt (PT) ≥ 25° AND undergoing posterior spinopelvic fusion with the upper instrumented vertebra (UIV) being between T8 to T12.

Patient preoperative age, sex and body mass index (BMI) were recorded. Preoperative and the 2-year postoperative radiographic parameters including the major curve coronal Cobb angle, SVA, lumbar lordosis (LL), pelvic incidence (PI) and pelvic-incidence to lumbar lordosis mismatch (PI-LL), were calculated.

## STATISTICAL ANALYSIS

Patient demographic details and radiographic parameters are presented as a mean and range. The mean differences for each radiographic parameter and ODI domain between the preoperative and the 2-year follow-up were calculated and a student *t*-test performed to assess statistical significance. A $p$-value < 0.05 was considered significant.

## RESULTS

A total of 45 consecutive patients undergoing spinopelvic fusion for ASD were enrolled. The average age was 64

**TABLE I**

CHANGES IN THE RADIOGRAPHIC PARAMETERS FROM PREOPERATIVE TO 2-YEAR POSTOPERATIVE

| Radiographic parameter | Preoperative | Postoperative | *p*-value |
|---|---|---|---|
| **Major Cobb angle** | 30º | 14.6º | *0.000* |
| **SVA** | 6.9 cm | 4.6 cm | *0.039* |
| **LL** | 28.4º | 44º | *0.000* |
| **PI-LL** | 27.0º | 9.5º | *0.000* |

**SVA**: sagittal vertical axis **LL**: lumbar lordosis **PI-LL**: pelvic incidence to lumbar lordosis mismatch

years (range 22 - 81 years), 38 were female (7 male) and the average body mass index (BMI) was 27.3 (range 19.1 - 42.7).

Table I displays the radiographic parameters. The average preoperative major Cobb angle was 30º (range 0 - 90º), SVA was 6.9 cm (range: -3.7 - 20.3 cm), LL was 28.4º (range -13º - 68º) and PI-LL was 27.0º (range -3º - 61º).

At the 2-year follow-up the average major Cobb angle was 14.6º (range 0-71º), SVA was 4.6 cm (range -6.6 - 14.4 cm), LL was 44º (range 15 - 75º) and PI-LL mismatch was 9.5º (range -16 - 39º).

The ODI significantly decreased after surgery (52.0 *vs*. 38.5; $p = 0.001$). Large (more than 1 point) improvements were observed for: pain intensity and sexual life. Moderate (0.5-1 point) changes were observed for walking, sitting, standing, social life and traveling. No changes (less than 0.2) were observed for personal care, lifting and sleeping (Figure 1). Similarly, statistically significant changes were observed in all domains except personal care, lifting and sleeping.

## DISCUSSION

This study confirms that spinopelvic fusion significantly improves the overall ODI score at the 2-year follow-up for patients with ASD [10]. The mean 13.5% overall improvement in disability is predominantly attributed to a reduction in pain, but it is also attributed to improvement in all domains. However, when assessing the change in each domain independently a variable degree of benefit is found.

Large improvements in pain and sexual function, with moderate improvements in walking, sitting, standing, social life and traveling were identified. In contrast, clinically and statistically insignificant improvements were found in sleeping, personal care and lifting (Figure 1).

This suggests that spinopelvic fusion in patients with ASD variably improves different aspects of a patient's ADLs. We feel that these results depict the benefit of stabilizing and balancing the deformed spine to improve pain and balance which subsequently improves daily functional activities such as walking, sitting and standing as well as traveling, social life and sexual function. However, the rigidity imparted by the fusion limits the improvement in personal care and lifting. This is easily explained by the limited spinal mobility affecting personal care, such as foot care and ability to lift objects from the floor. However, we are uncertain as to why there is no significant improvement in sleeping, particularly considering the degree of analgesia provided by the procedure, but recognize that ASD predominantly affects patients during upright activities.

Despite the limited improvement in sleeping, personal care and lifting, it should be recognized that the results of this study suggest an improvement, all be it statistically and clinically insignificant, in these domains. Thus, there is no evidence to suggest the stiffness induced by this procedure worsens any functional activities. We feel this relates to the spine in patients with ASD already being stiff with limited functional mobility and thus definitive fusion causes minimal additional stiffness.

Recognizing the overall benefit of spinopelvic fusion on functional activities and quality of life in patients with ASD allows surgeons to advocate such an approach to this condition. However, understanding the specific benefits such as a large improvement in pain and sexual function, a moderate improvement in walking, sitting, standing, social life and traveling and a limited improvement in sleeping, personal care and lifting, allows informed patient consent and clearer patient expectations, that may in turn guide the patient and surgeon's decision regarding treatment.

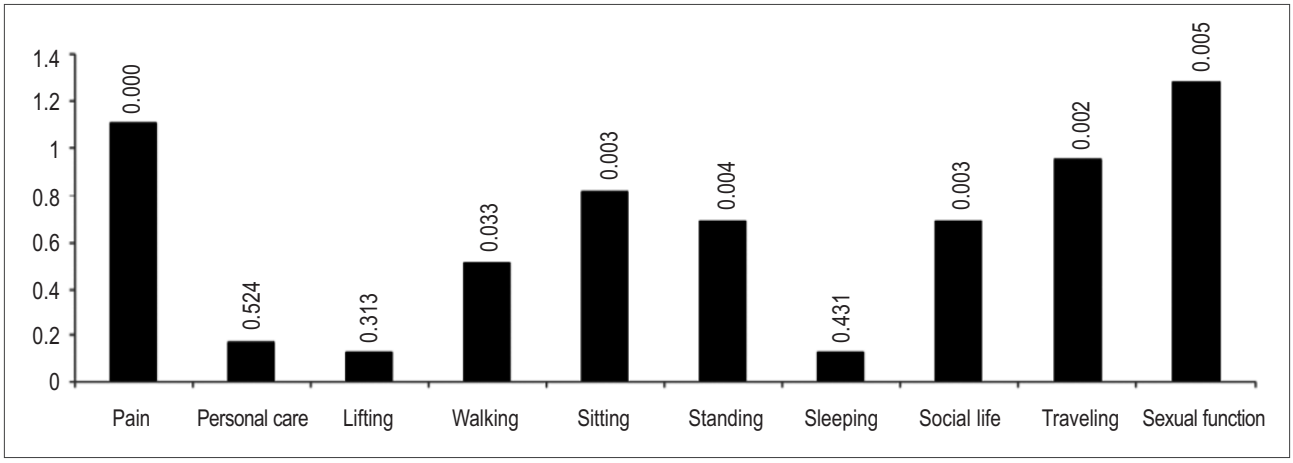


**Figure 2.** Changes from preoperative to the 2-year postoperative scores in each ODI domain with *p*-value displayed above each column

This study is limited by its lack of specificity as all patients with ASD, irrelevant of underlying cause, curve type, degree of deformity and preceding symptoms, were included. However, we elected to use this group of consecutive patients because it reflected normal clinical practice. In addition, this study only assesses ODI and not other HRQL scores [8,9]. We elected to only assess ODI because of its widespread use and its simplistic assessment of common ADLs.

Despite these limitations, we feel that this study addresses the common questions raised by patients and clinicians as to the specific benefits likely to be achieved by spinopelvic fusion in ASD.

## CONCLUSION

Spinopelvic fusion reduces the overall level of disability in patients with ASD. Specifically, it provides a large improvement in pain and sexual function, a moderate improvement in walking, sitting, standing, social life and traveling and a limited improvement in sleeping, personal care and lifting. This information should be used to fully inform patients of the specific benefits provided by spinopelvic fusion in ASD.

## ACKNOWLEDGMENT

We would like to thank Glynny Kieser for her editorial input.

## REFERENCES

1. Salomon JA, Haagsma JA, Davis A et al. Disability weights for the Global Burden of Disease 2013 study. Lancet Glob Health 2015; 3 (11): e712-e723.
2. Good CR, Auerbach JD, O'Leary PT, Schuler TC. Adult spine deformity. Curr Rev Musculoskelet Med 2011; 4 (4): 159-67.
3. Schwab F, Dubey A, Gamez L et al. Adult scoliosis: prevalence, SF-36, and nutritional parameters in an elderly volunteer population. Spine (Phila Pa 1976) 2005; 30 (9): 1082-5.
4. Lafage V, Schwab F, Patel A, Hawkinson N, Farcy JP. Pelvic tilt and truncal inclination: two key radiographic parameters in the setting of adults with spinal deformity. Spine (Phila Pa 1976) 2009; 34 (17): E 599-606.
5. Schwab FJ, Blondel B, Bess S et al. Radiographical spinopelvic parameters and disability in the setting of adult spinal deformity: a prospective multicenter analysis. Spine (Phila Pa 1976) 2013; 38 (13): E 803-12.
6. Glassman SD, Bridwell K, Dimar JR, Horton W, Berven S, Schwab F. The impact of positive sagittal balance in adult spinal deformity. Spine (Phila Pa 1976) 2005; 30 (18): 2024-9.
7. Fairbank JC, Couper J, Davies JB, O'Brien JP. The Oswestry low back pain disability questionnaire. Physiotherapy 1980; 66 (8): 271-3.
8. Asher M, Min Lai S, Burton D, Manna B. The reliability and concurrent validity of the scoliosis research society-22 patient questionnaire for idiopathic scoliosis. Spine (Phila Pa 1976) 2003; 28 (1): 63-9.
9. Ware JE Jr., Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. Med Care 1992; 30 (6): 473-83.
10. Daubs MD, Lenke LG, Cheh G, Stobbs G, Bridwell KH. Adult spinal deformity surgery: complications and outcomes in patients over age 60. Spine (Phila Pa 1976) 2007; 32 (20): 2238-44.