

Revision Surgery after Three Column Osteotomy (3CO) in 335 Adult Spinal Deformity (ASD) Patients: Intercenter Variability and Risk Factors

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Introduction

Complex spinal osteotomies including 3CO are performed to correct ASD. 3CO procedures are associated with high complication rates, but risk factors and variability among centers for surgical revision have not been reported.

Methods

Multicenter, retrospective review of ASD patients who underwent 3CO (n=335). Incidence and indication for revision surgery were analyzed. Revision surgery (RS) indications were classified as "Mechanical" (MR: implant failure, pseudarthrosis, junctional failure, loss/lack of correction) or "Non Mechanical" (NMR: neurologic deficit, infection, wound dehiscence, stenosis).

Results

3month and 1year revision surgery incidences were 12.3% and 17.6%. Single-level 3CO (n=311) had smaller RS rates than multi-level 3CO (n=24, 15.7% vs. 41.7%, p=0.01, OR=0.26). Thoracic (n=63) and lumbar 3CO (n=246) demonstrated similar RS rates (12.7% vs. 16.7%, p=0.112, OR=1.32). Rate of RS for single-level lumbar 3CO was 16.7% (MR=11.4%, NMR=5.7%). For all revisions, 50% of MR and 78.6% of NMR occurred within 3mo of index surgery.

		E	Before Three N	lonths		Before One	Year
		Ν	Incidence	%	Ν	Incidence	%
Mechanical	Hardware Failure	10	3.0%	20.8%	15	4.5%	20.8%
ani	Pseudarthrosis	5	1.5%	10.4%	10	3.0%	13.9%
chi	PJK	8	2.4%	16.7%	13	3.9%	18.1%
Me	Sagittal Imbalance	2	0.6%	4.2%	7	2.1%	9.7%
nical	Neurological Deficit	6	1.8%	12.5%	7	2.1%	9.7%
echar	Infection Wound Dehiscence	7	2.1%	14.6%	7	2.1%	9.7%
Non-Mechanical	Painful Hardware	1	0.3%	2.1%	3	0.9%	4.2%
ž	Stenosis	3	0.9%	6.3%	3	0.9%	4.2%
Other	Other	4	1.2%	8.3%	5	1.5%	6.9%
ot	Unknown	2	0.6%	4.2%	3	0.9%	4.2%

Table 1. Incidence of RS within three months and one year of index three-column osteotomy, and reason for revision.

There was significant variation in revision surgery rates across sites (range=2.5-32.4%, p=0.004), however low- and high-volume sites had similar revision surgery rates (18.2% vs. 16.2%, p=0.503, OR=1.38).

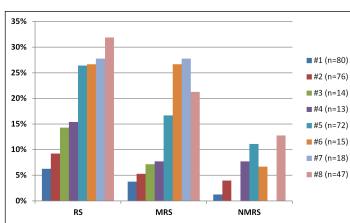


Figure 2. Graphical depiction of revision surgery (RS) incidence within one year of the index procedure across sites, and breakdown of RS by mechanical (MRS) or non-mechanical (NMRS) reasons.

Patients who required mechanical revision were more likely to be under-corrected three months after the index procedure (SVA=7cm vs 3.2cm, p=0.003) and had a more caudal 3CO (L4 vs L3, p=0.014).

The risk factors analysis revealed that SVA at threemonths and the treatment center were the only two parameters predictive of mechanical revision and for overall revision surgery incidence due to pseudarthrosis (p<0.02). Patients who underwent non-mechanical revisions had larger 3CO resections than patients that did not have non-mechanical revision surgery (34° vs 24.5°, p=0.003).

		PreOp	6wk	3mo	1yr
	T1SPI (°)	4.4	-2.4	-2.1	-2.6
u n	SVA (mm)	135.1	36	47.8	42
Revision	ΤΚ (°)	-53.3	-49.7	-55	-54.3
Re	PI-LL	31.5	2.5	2.8	4.5
	PT (°)	30.8	19.6	20.3	21.8
_	T1SPI (°)	2.7	-3.2	-4.4	-4.3
sior	SVA (mm)	119.2	40.9	28.1	31
Revision	ΤΚ (°)	-55.9	-50.8	-52.9	-53.2
NoF	PI-LL	27.5	6.3	5.1	5.6
~	PT (°)	30.2	22.2	22.7	23.7

Figure 3. Comparison of pelvic parameters between patients who underwent RS and those who did not.

Conclusions

3CO procedures for ASD surgery provide deformity correction despite established complication and revision rates. There is great interest in lowering revision surgery rates, particularly in high-risk osteotomy cases, due to their impact on the patient and healthcare system. This study shows that revision surgery is associated with lower level osteotomy and greater SVA. There is significant variability in revision rates across sites, which may be a reporting bias or technique difference.

Learning Objectives

By the conclusion of this session, participants should be able to: (1) Appreciate the revision rates associated with use of three-column osteotomies in the surgical treatment of adult spinal deformity; (2) Appreciate the risk factors and variability among centers for surgical revision associated with threecolumn osteotomies performed for adult spinal deformity correction.

References

Lafage V, Smith JS, Bess S, et al. Sagittal spinopelvic alignment failures following three column thoracic osteotomy for adult spinal deformity. Eur Spine J 2012;21:698-704.