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# Triple level cervical disc arthroplasty: an effective alternative to ACDF or hybrid procedures in multilevel degenerative disc disease

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## Introduction

Traditionally, ACDF has been the gold standard. However, fusion causes hypermobility and increased intradiscal pressure at adjacent segments, accelerating ASD. In multilevel fusion, this effect is multiplied with a cumulative 7 degrees lost per additional level fused.
In contrast, CDA offers motion preservation, thereby lowering the rate of ASD. Despite growing level 1 evidence proving the efficacy of CDA in 1-2 level disc replacements, triple level CDA currently goes beyond the extent of FDA approval.
Given these limitations, hybrid surgery allows tailored treatment, combining fusion and replacement, balancing between stability and motion preservation.
Whilst there have been various studies comparing double level constructs, there are few studies comparing between triple level constructs, and the optimal treatment remains uncertain.
Therefore, we conducted this study to assess the efficacy of triple level CDA and how it compares with fusion and hybrid surgery.

## Materials and Methods

27 patients with triple level reconstructive procedures

Clinical outcomes
- VAS neck and arm pain
- Neck disability index (NDI)
- Short-form-12 for Physical Component Summary (SF-PCS) and Mental Component Summary (SF-MCS)

Radiological outcomes
- C2-C7 cervical lordosis (CL) + range-of-motion (ROM)
- Superior adjacent segment ROM (AS ROM)

## Results

| Group | All (n=27) | ACDF (n=4) | HS (n=9) | CDA (n=14) | P value |
|---|---|---|---|---|---|
| Age | 58.6 ± 11.2 | 73.5 ± 6.81 | 57.8 ± 9.73 | 55 ± 10.1 | 0.009 |
| Gender (M/F) | 16 (59.3%) / 11 (40.7%) | 2 (50%) / 2 (50%) | 5 (55.6%) / 4 (44.4%) | 9 (64.2%) / 5 (35.7%) | 0.859 |
| Indication | | | | | 0.029 |
| Myelopathy | 10 (37.0%) | 4 (100%) | 4 (44.4%) | 2 (14.3%) | |
| Radiculopathy | 12 (44.4%) | - | 3 (33.3%) | 9 (64.3%) | |
| Both | 5(18.5%) | - | 2 (22.2%) | 3 (21.4%) | |
| CL (pre-op) | 5.85 ± 11.88 | 10.5 ± 21.3 | 7.22 ± 11.8 | 3.64 ± 8.84 | 0.563 |
| C2-C7 ROM (pre-op) | 39.3 ± 14.0 | 33.0 | 35.6 ± 15.3 | 43.2 ± 13.4 | 0.512 |
| Segment | | | | | 0.580 |
| C3-C6 | 18 (66.7%) | 3 (75%) | 7 (77.8%) | 8 (57.1%) | |
| C4-C7 | 9 (33.3%) | 1 (25%) | 2 (22.2%) | 6 (42.9%) | |
| Combination | | | | | |
| FFF | | 4 | - | - | |
| RFF | | - | 3 (33.3%) | - | |
| FFR | | - | 6 (66.7%) | - | |
| RRR | | - | - | 14 | |
| Operative duration (mins) | 224 ± 48.3 | 227 ± 68 | 236 ± 44 | 216 ± 48 | 0.632 |
| LOS (days) | 5.63 ± 4.60 | 10 ± 4.8 | 6.44 ± 6.31 | 3.86 ± 1.66 | 0.044 |
| Follow-up (months) | 8.48 ± 4.04 | 9.25 ± 3.77 | 10.3 ± 4.80 | 7.07 ± 3.25 | 0.155 |

Table 1. Patient demographics

## Results

VAS scores
- All patients had improvement in VAS neck and arm scores, with no significant difference between groups.
- Of note, within the CDA group, there was a significant improvement at 1m postoperatively.

NDI
- There was significant improvement in both groups, with no significant difference between groups.

SF-MCS
- Overall improvement in both groups, however at 3m CDA was significantly better than HS.

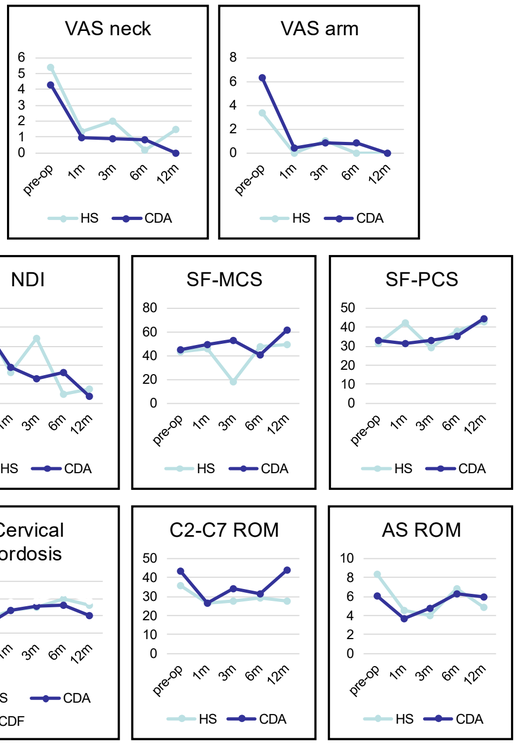
SF-PCS
- Overall improvement in both groups, with no significant difference between groups.

CL
- Mean CL across all 3 groups improved significantly. There was no significant difference in restoration of lordosis between groups.

ROM
- In the CDA group, at 12m, ROM was restored to preoperative range and was significantly better as compared to the HS group.

AS ROM
- AS ROM did not increase significantly in both groups. There was no significant difference in AS ROM between HS and CDA. This may be due to the proportion of adjacent segments within the Hs group are adjacent to disc replacement rather than a fusion. Further, it may be too early for the effect on adjacent segments to be apparent.

Adverse events
- Whilst most of the adverse events came from the CDA group, this may be contributed by the disproportionately high number of CDA patients in our study. Nevertheless, there were no reoperations required.




| Adverse event | ACDF | CDA | HS |
|---|---|---|---|
| Dysphagia | - | 1 | - |
| Durotomy | - | 1 | - |
| Heterotopic ossification | - | 1 | 1 |
| Reperfusion injury | - | 1 | - |

## Conclusion

ACDF, CDA, and HS are all effective in treating multilevel DDD
The benefit of motion preservation is sustained in triple level CDA at 12m postoperatively, with at least equivalent or superior clinical outcomes when compared with ACDF or HS.

## Disclaimer

The authors have no conflict of interests to declare.