Deep Brain Stimulation Versus Peripheral Denervation for Cervical Dystonia: A Systematic Review and Meta-Analysis

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Introduction

Cervical dystonia is a disabling medical condition that drastically decreases quality of life. Surgical treatment consists of deep brain stimulation (DBS) or peripheral nerve denervation procedures with or without myectomies. The current objective was to compare the efficacy of DBS versus peripheral denervation in improving severity of cervical dystonia through a systematic review and meta-analysis.

Methods

A search of PubMED, MEDLINE, EMBASE and Web of Science electronic databases was conducted in accordance with PRISMA guidelines. Pre-and post-operative Toronto Western Spasmodic Torticollis Rating Scale (TWSTRS) severity scores were used to generate standardized mean differences and 95% confidence intervals, which were combined in a random-effects model.
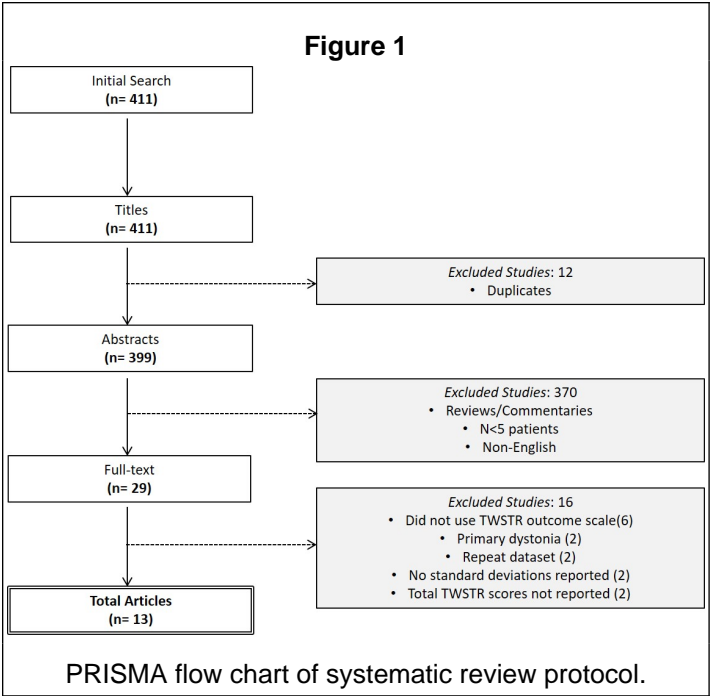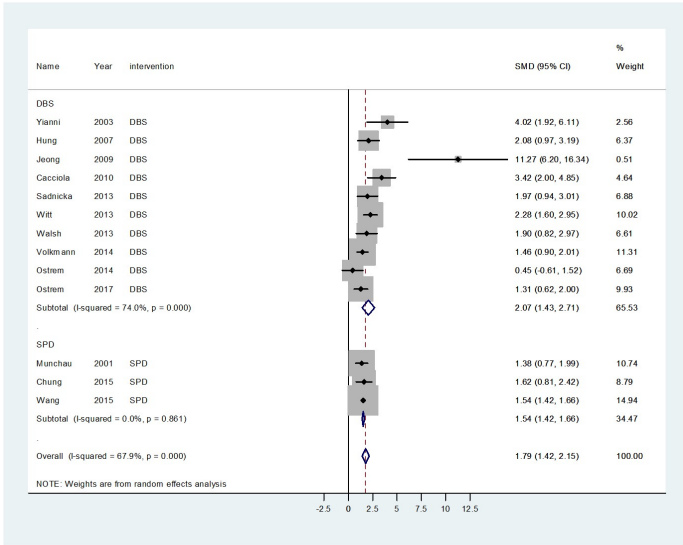

Figure 1

PRISMA flow chart of systematic review protocol.

Figure 2

Forest plot generated using a random-effects model, with subgroup analysis between DBS and peripheral denervation (SPD) groups.

Results

Thirteen studies met inclusion criteria, comprising 830 patients with 140 undergoing DBS and 690 undergoing peripheral denervation procedures. Mean follow-up was 31.5 months. Comparing the two surgical treatments (for summary purposes), mean percentage reduction in post-operative total TWSTR scores were 53.0% and 39.1 % following DBS and peripheral denervation surgery, respectively (p=0.09, Mann-Whitney rank sum test). In assessing efficacy of each intervention, forest plots revealed significant improvement in total post-operative TWSTR scores for both peripheral denervation (standardized mean difference 1.54; 95% confidence interval 1.42-1.66; p<0.001) and DBS (standardized mean difference, 2.07; 95% confidence interval 1.43-2.71; p<0.001), respectively. On subgroup analysis, DBS therapy was significantly associated with improvement in post-operative TWSTR severity score (standardized mean difference, 2.08; 95% confidence interval 1.66-2.50; p=0.004).

Figure 3

First author	Year	Study design	Intervention	Size	Follow-up duration mean ± SD, months)	Pre-operative total TWSTRS score (mean ± SD)	Post-operative total TWSTRS score (mean ± SD)	% improvement
Munchau	2001	Prospective cohort study	SPD	26	16.7±12.6	47.0±10	31.0±13	34
Yianni	2003	Retrospective cohort study	DBS	6	18.9	57.8±8.2	23±9.1	60
Hung	2007	Longitudinal cohort study	DBS	10	31.9±20.9	53.7±17.2	23.2±11.6	57
Jeong	2009	Consecutive case series	DBS	6	18.7±11.1	60.5±3.6	15.8±4.3	74
Cacciola	2010	Consecutive case series	DBS	10	37.6±16.9	55.7±8.3	17.6±13.4	68
Sadnicka	2013	Case-control study	DBS	11	26±15	50±12.2	18±19.4	64
Witt	2013	Retrospective cohort study	DBS	28	33.7±25.0	53.5±10.3	24.2±15	55
Walsh	2013	Prospective single-blind cohort	DBS	10	21.5±4.6	54.5±12.4	29±14.4	47
Volkmann	2014	Randomized sham-controlled trial	DBS	32	19.9±3.7	45.9±9.9	27.8±14.5	40
Ostrem	2014	Prospective cohort study	DBS	7	12	36±9.7	31.8±8.8	12
Chung	2015	Retrospective cohort study	SPD	16	19.9±11.5	24.9±8	14.9±3.6	40
Wang	2015	Retrospective cohort study	SPD	648	33.4	54.7±18.3	31.1±11.6	43
Ostrem	2017	Prospective cohort study	DBS	16	36	41.0±18.9	18.8±14.8	54

Characteristics of the included 13 studies. Standard deviation included where reported

Conclusions

Comparing DBS versus peripheral denervation for the treatment of cervical dystonia, no significant difference in severity reduction was seen. While substantially more data was available in the DBS cohort, it appears DBS was effective at reducing severity of cervical dystonia as assessed by the TWSTR outcome scale.

References

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