Does Botulinum neurotoxin-A intramuscular injection induce local muscular weakness in adult-onset neurological patients with focal muscle spasticity? A Systematic Review.

Ms. Renée Gill[1,2*], Dr. Megan Banky[1,2], Mr. Zonghan Yang[2], Mr. Pablo Medina Mena[1], Ms. Chi Ching Angie Woo[1], Assoc. Prof. Adam Bryant[2], Prof. John Olver[1,3], Dr. Elizabeth Moore[1] and Prof. Gavin Williams[1, 2]

1 Department of Physiotherapy, Epworth Rehabilitation, Epworth Healthcare, Melbourne, Australia.
2 School of Physiotherapy, The University of Melbourne, Melbourne, Australia.
3 Department of Medicine, Monash University, Melbourne, Australia.
*Correspondence: renee.gill@epworth.org.au

Introduction:

Botulinum neurotoxin-A (BoNT-A) injections are commonly used and effective for the treatment of focal spasticity. However, the impact on strength is widely unknown. This study aimed to investigate the effect of BoNT-A injections on focal muscle strength in adult-onset neurological conditions.

Methods:

A systematic literature search of eight databases was completed in March 2024. The methodology and reporting of results were performed following the PRISMA guidelines and registered with PROSPERO (CRD42022315241). Quality was assessed using the modified Downs and Black checklist and PEDro scales by two independent reviewers. A meta-analysis was precluded due to the heterogeneity of studies and outcome measures.

PRISMA Flow Diagram:

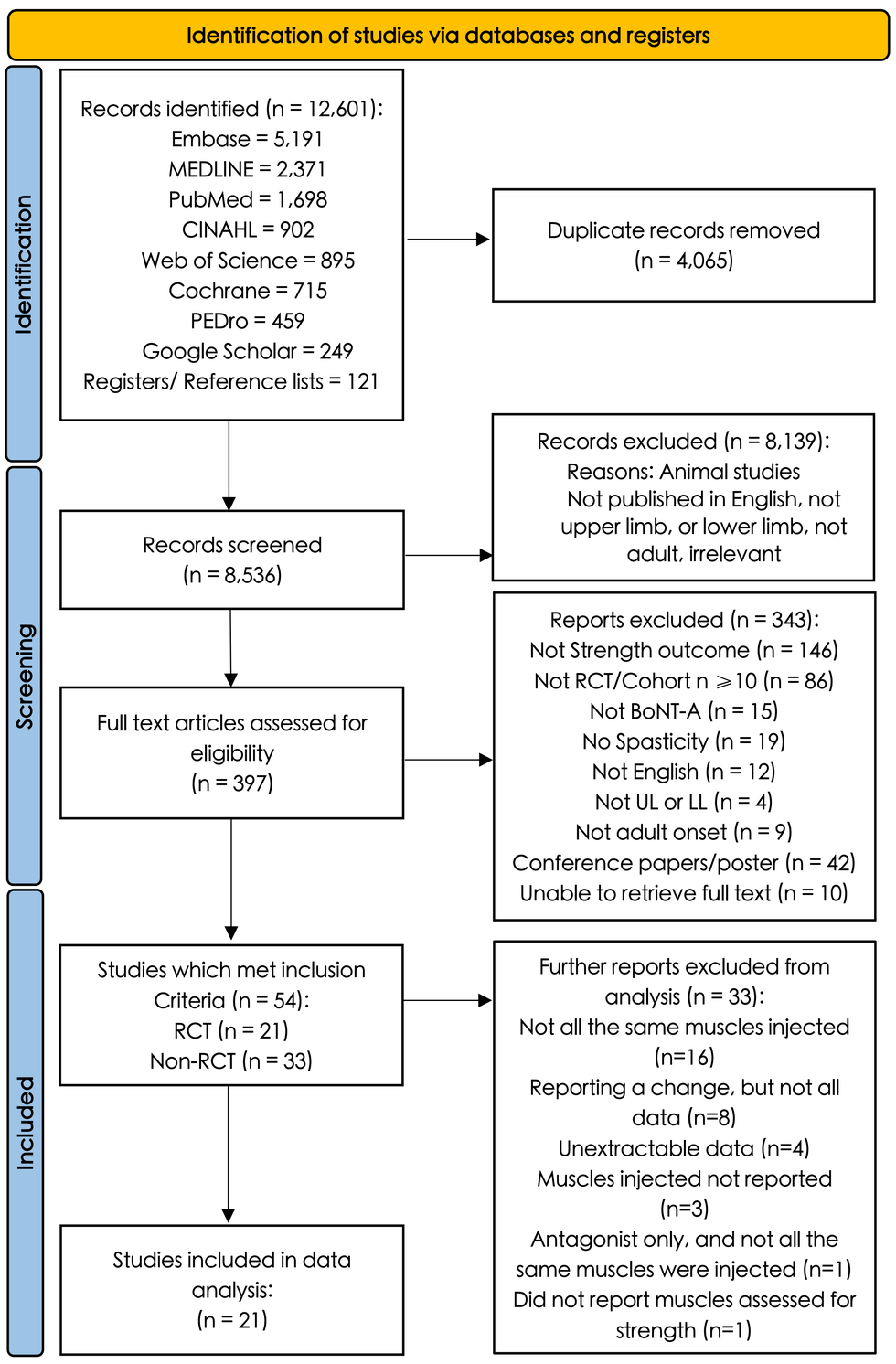

Figure 1. Flow diagram of study identification to obtain articles for inclusion in the review.

Results:

Fifty-four studies met the inclusion criteria, however, only 21 were included in the analysis. Most strength results post BoNT-A injections were non-significant or not reported in both injected and opposing muscle groups. Strength was assessed mostly within 6 weeks and no greater than 6 months post-injection. More than 12 different strength outcome measurement tools were used. Data quality was rated between fair and good on the modified Downs and Black checklist[1] and PEDro[2] scales with average scores of 16/28 and 7/10, respectively.

Strength Results post BoNT-A	Upper Limb			Lower Limb		
	Stronger	NS/NR	Weaker	Stronger	NS/NR	Weaker
Injected muscles	11%	74%	15%	0%	95%	5%
Opposing muscles/ Non-injected	36%	64%	0%	26%	74%	0%

NS - Non-significant, NR – Not reported

Figure 2. Strength results of the upper and lower limb injected and opposing muscles from articles included in the analysis (n=21).

Discussion:

Due to the large proportion of non-significant results, low discriminative ability of the outcome measure used and low-quality evidence, the impact of BoNT-A on muscle strength was difficult to determine. The results indicate the opposing muscle group may strengthen; however, this should be interpreted with caution. Despite some statistically significant results, clinical significance remains unknown.

Conclusions:

- Overall, the impact of BoNT-A on muscle strength was inconclusive.
- The impact of BoNT-A injections on muscle strength, when examining long-term outcomes greater than 3 months remains unclear.
- Many of the clinical strength measures used have limited capacity to detect change.
- High-quality evidence is required to examine the impact of BoNT-A injections on muscle strength directly.
- Further investigations may determine the impact BoNT-A injections has on muscle strength, and the impact on function.

References:

1. Downs, S. H., & Black, N. (1998). The feasibility of creating a checklist for the assessment of the methodological quality both of randomised and non-randomised studies of health care interventions. *Journal of epidemiology & community health, 52* (6), 377-384.
2. Physiotherapy Evidence Database (PEDro). (n.d.). PEDro Scale. Retrieved from https://pedro.org.au/english/resources/pedro-scale/ (Date Accessed 19th of March 2024)