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Accuracy of Ultrasound-Guided and Non-Guided Botulinum Toxin Injection into Cadaver Neck Muscles

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Objective

To compare the accuracy of ultrasound-guided and non-guided botulinum toxin injection into the neck muscles involved in cervical dystonia.

Methods

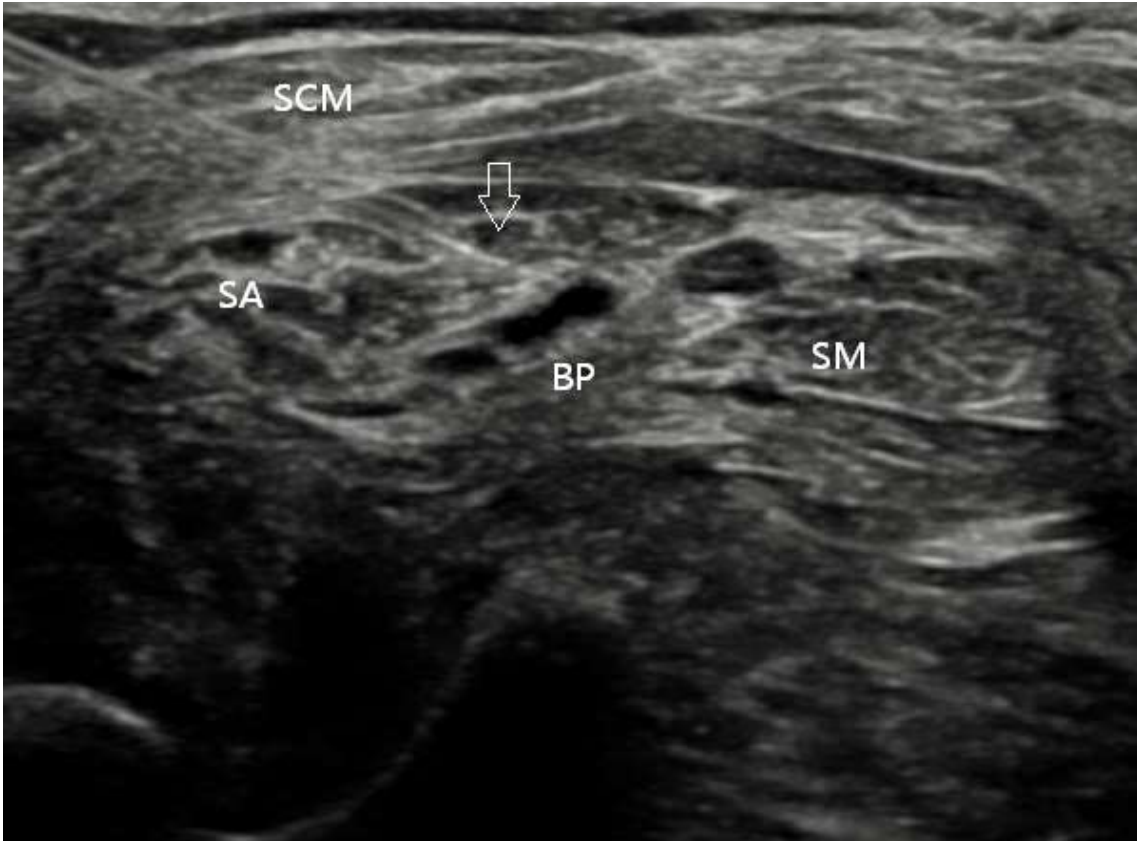
Two physiatrists examined the six muscles (sternocleidomastoid, trapezius, levator scapulae, splenius capitis, scaleneus anterior, scaleneus medius muscles) in each of six fresh cadavers. Each physician injected dye into one side of each cadaver using ultrasound-guided or non-guided injection procedure. For each injection technique, different color dyes were used. Dissection was performed to identify the results of the injection. The injection procedure was regarded to be 'accurate' when the dye was visualized in the target muscle and to be 'inaccurate' when it was not seen in the target muscle. According to difficulty of access, six muscles were divided into sternocleidomastoid, trapezius muscles (group A) and levator scapulae, splenius capitis, scaleneus anterior, scaleneus medius muscles (group B). We compared the overall accuracies, the accuracy in each muscle and the accuracies in two groups.

Results

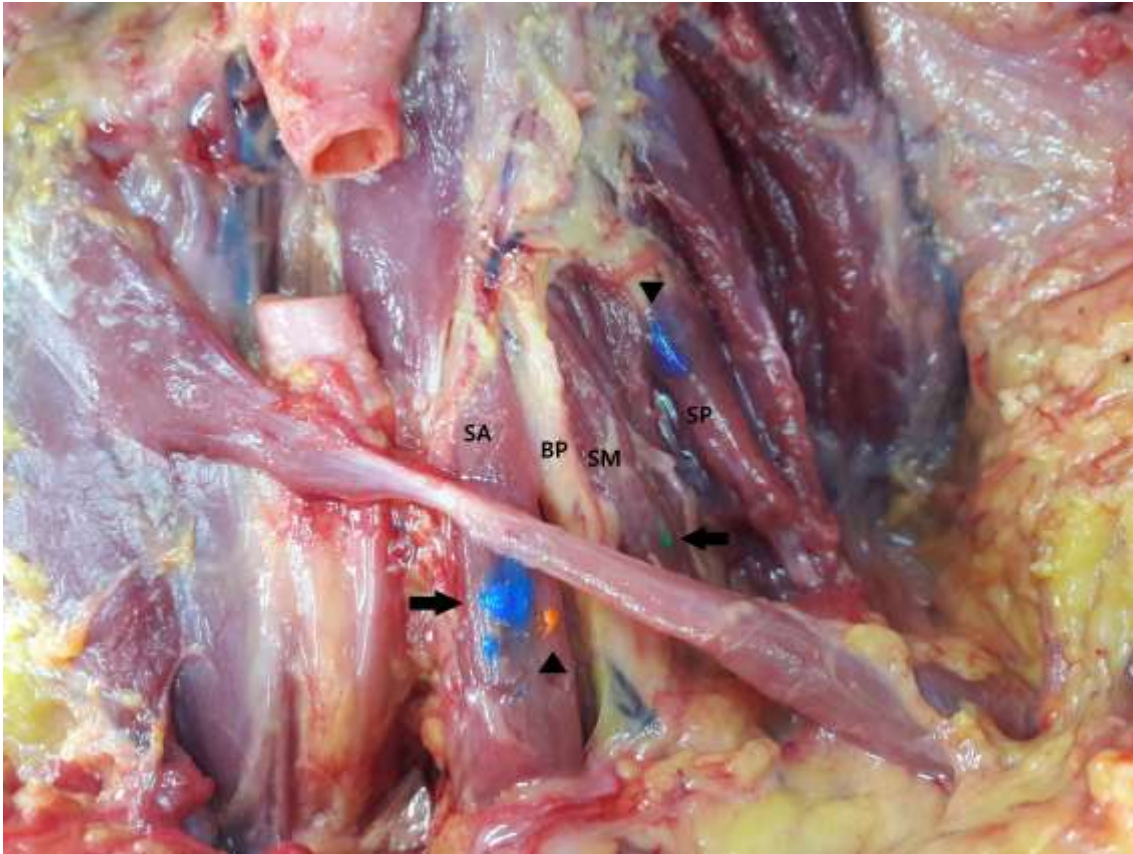
Overall accuracies of the US-guided and non-guided injections into the neck muscles were 97.22% and 59.72% ($p=0.000$). For each muscle specific, the accuracies of the US-guided and non-guided injections in the sternocleidomastoid muscle were 100% and 79.17% ($p=0.022$), in the trapezius muscle were 100% and 75.00% ($p=0.011$), in the levator scapulae muscle were 91.67% and 41.67% ($p=0.000$), in the splenius capitis muscle were 95.83% and 59.72% ($p=0.000$), in the scaleneus anterior muscle were 95.83% and 50.00% ($p=0.000$) and in the scaleneus medius muscle were 100% and 50.00% ($p=0.000$). Accuracies of the ultrasound-guided injections into the group A and group B were 100% and 95.83% ($p=0.045$). Accuracies of the non-guided injections into the group A and group B were 77.09% and 51.04% ($p=0.001$). There was no significant difference in accuracies between the two physicians ($p=0.775$).

Conclusion

Ultrasound-guided botulinum toxin injection into the neck muscles offers significantly greater accuracy over non-guided injection. It is also preferable to perform ultrasound guided injection in not only deep muscles but also superficial muscles.



Ultrasound-guided dye injection into the scaleneus anterior muscle. Intraglandular injectate (arrow) are shown in this figure. SCM, sternocleidomastoid; SA, scaleneus anterior; SM, scaleneus medius; BP, brachial plexus.



Dissected cadaver with ultrasound-guided injection (blue and green dye, arrow head) and non-guided injection (yellow and purple dye, arrow head). Non-guided injection that was incorrectly placed into the scaleneus posterior muscle. SA, scaleneus anterior; SM, scaleneus medius; SP, scaleneus posterior; BP, brachial plexus.

Table 1.. Numbers in parentheses indicate number of attempts. p-value between the accuracy of non-guided and ultrasound-guided injections.

Muscles	Non-guided		Ultrasound-guided		P-value
	Correct placement	Accuracy (%)	Correct placement	Accuracy (%)	
Sternocleidomastoid					
physiatrist 1	10(12)	83.33	12(12)	100	
physiatrist 2	9(12)	75.00	12(12)	100	
Total	19(24)	79.17	24(24)	100	0.022
Trapezius					
physiatrist 1	9(12)	75.00	12(12)	100	
physiatrist 2	9(12)	75.00	12(12)	100	
Total	18(24)	75.00	24(24)	100	0.011
Levator scapulae					
physiatrist 1	4(12)	33.33	12(12)	100	
physiatrist 2	6(12)	50.00	10(12)	83.33	
Total	10(24)	41.67	22(24)	91.67	0.000
Splenius capitis					
physiatrist 1	7(12)	58.33	11(12)	91.67	
physiatrist 2	8(12)	66.67	12(12)	100	
Total	15(24)	62.50	23(24)	95.83	0.005
Scaleneus anterior					
physiatrist 1	6(12)	50.00	12(12)	100	
physiatrist 2	6(12)	50.00	11(12)	91.67	
Total	12(24)	50.00	23(24)	95.83	0.000
Scaleneus medius					
physiatrist 1	5(12)	41.67	12(12)	100	
physiatrist 2	7(12)	58.33	12(12)	100	
Total	12(24)	50.00	24(24)	100	0.000
Overall accuracy	86(144)	59.72	140(144)	97.22	0.000