



New surface anatomy approach to the levator scapulae muscle for optimal needle insertion : A cadaveric study

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Background

Accurate detection of the levator scapulae muscle is critical for effective diagnostic and therapeutic interventions. The commonly used surface anatomy approach has not been validated and is less accurate than ultrasound-guided techniques. Therefore, we determined the needle insertion point for the levator scapulae using a new technique based on the anatomy of the scapula.

Method

This investigation used 15 fresh cadavers to explore the relationship between the acromial angle (AA) and medial tip (O) of the scapular spine. Based on the x-axis [the distance (L) from point O to point AA] and the y-axis perpendicular to the x-axis passing through point O, the barycentric coordinates were determined through the intersections of each axis and the superior angle of the scapula with the levator scapulae. Various ratios involving the established distance (L) were ascertained, and the new technique was compared with the conventional technique.

Results

The optimal site of the new technique was within 6~7% of distance L on the x-axis and 42~44% of distance L on the y-axis. This technique was significantly more accurate than the conventional technique (p = 0.006).

TABLE 1 Measurements and ratios of the distances from O to AA and the x, y-coordinates of optimal point D: comparison between males and females.

	Total (N = 30)		Female (N = 12)	Male (N = 18)	
	Mean±SD	95% CI	Mean±SD	Mean±SD	<i>p</i> - value
Length from the medial tip on the scapular spine to acromial angle (L) (mm)	120.94 ± 1.26	118.37– 123.51	122.34 ± 6.99	120.01 ± 6.86	0.346
x-coordinate of D (d) (mm)	7.68 ± 0.40	6.86–8.50	7.87 ± 2.51	7.56 ± 2.04	1.000
y-coordinate of D (d') (mm)	52.16 ± 0.78	50.56–53.77	50.91 ± 4.42	53.00 ± 4.12	0.134
Ratio of x-coordinate of D to length from the medial tip in the scapular spine to acromial angle (d/L)	0.06 ± 0.01	0.06–0.07	0.06 ± 0.02	0.06 ± 0.02	0.950
Ratio of y-coordinate of D to length from the medial tip in the scapular spine to acromial angle (d'/L)	0.43 ± 0.01	0.42–0.44	0.42 ± 0.04	0.44 ± 0.02	0.059

Values represent mean ± standard deviation.
95% CI, 95% confidence intervals
p-value using Mann-Whitney test
Abbreviations: Point O, medial tip of the scapular spine.
Point AA, acromial angle of the scapular spine.

TABLE 2 Comparison of the accuracy of the conventional and new techniques

	Conventional technique	New technique	<i>p</i> - value
Physician 1	(2/5)	(5/5)	
Physician 2	(1/5)	(4/5)	
total	(3/10)	(9/10)	<i>p</i> = 0.006*

Asterisks (*) indicate significant differences by Pearson’s Chi-square test.

Conclusion

Our technique based on the anatomy of the scapula and relative measurements should facilitate more accurate and efficient diagnostic and therapeutic procedures, such as botulinum toxin injections, needle electromyographic assessments, and trigger point injections into the levator scapulae muscle.

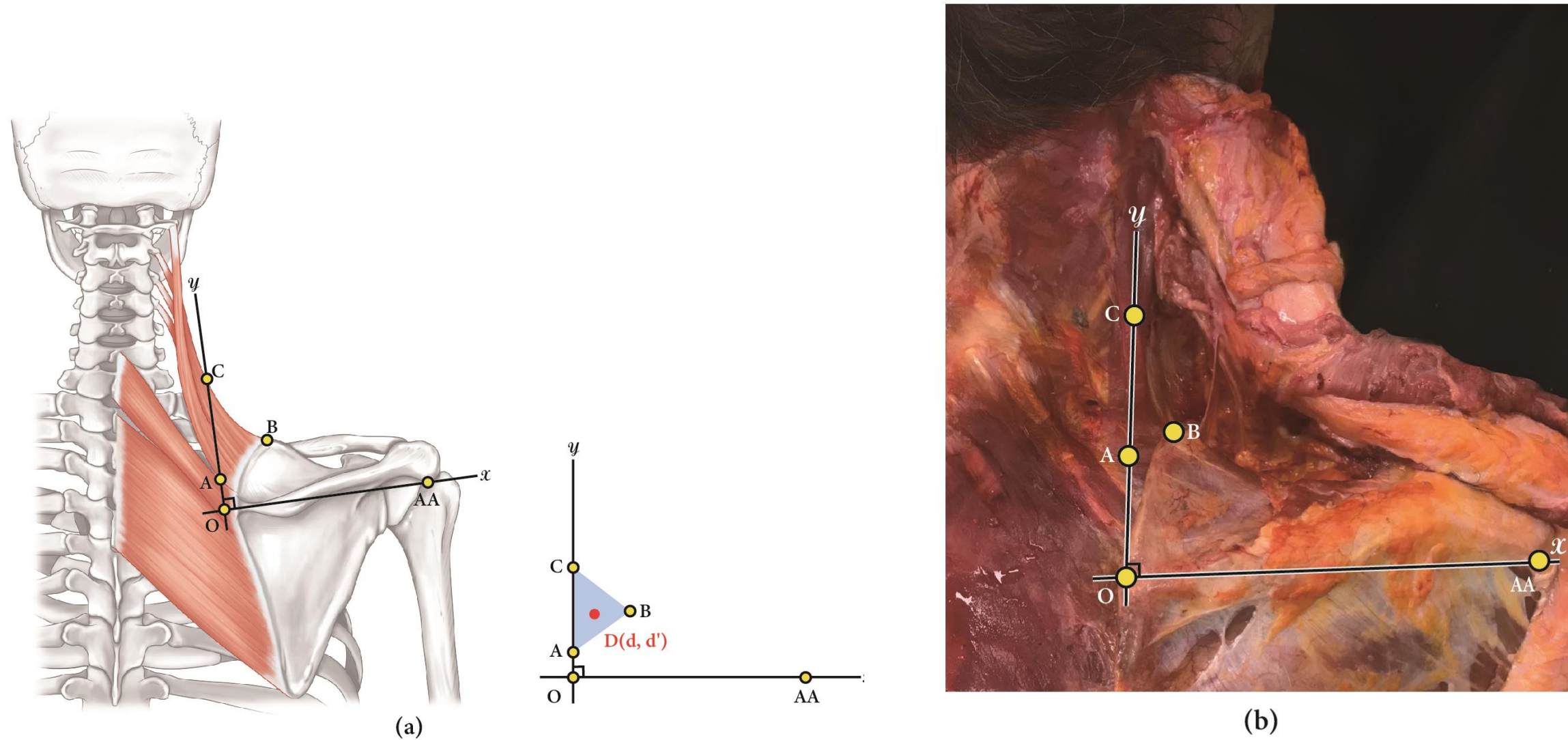


FIGURE 1 Schema of the measurement landmarks (a) and their actual location in the cadaver (b). The x-axis was designated based on the distance from the acromial angle of the scapular spine (AA) to the medial tip of the scapular spine (O). The y-axis is perpendicular to the x-axis passing through point O. Point O, medial tip of the scapular spine. Point AA, acromial angle of the scapular spine. Point A, the point where the y-axis and lower margin of the levator scapulae muscle meet. Point C, the point where the y-axis and upper margin of the levator scapulae muscle meet. Point B, the point where the levator scapulae muscle is inserted into the superior angle of the scapula. Point D (d, d'), barycentric coordinates of points A–C. It is calculated the sum of points A–C divided by 3.

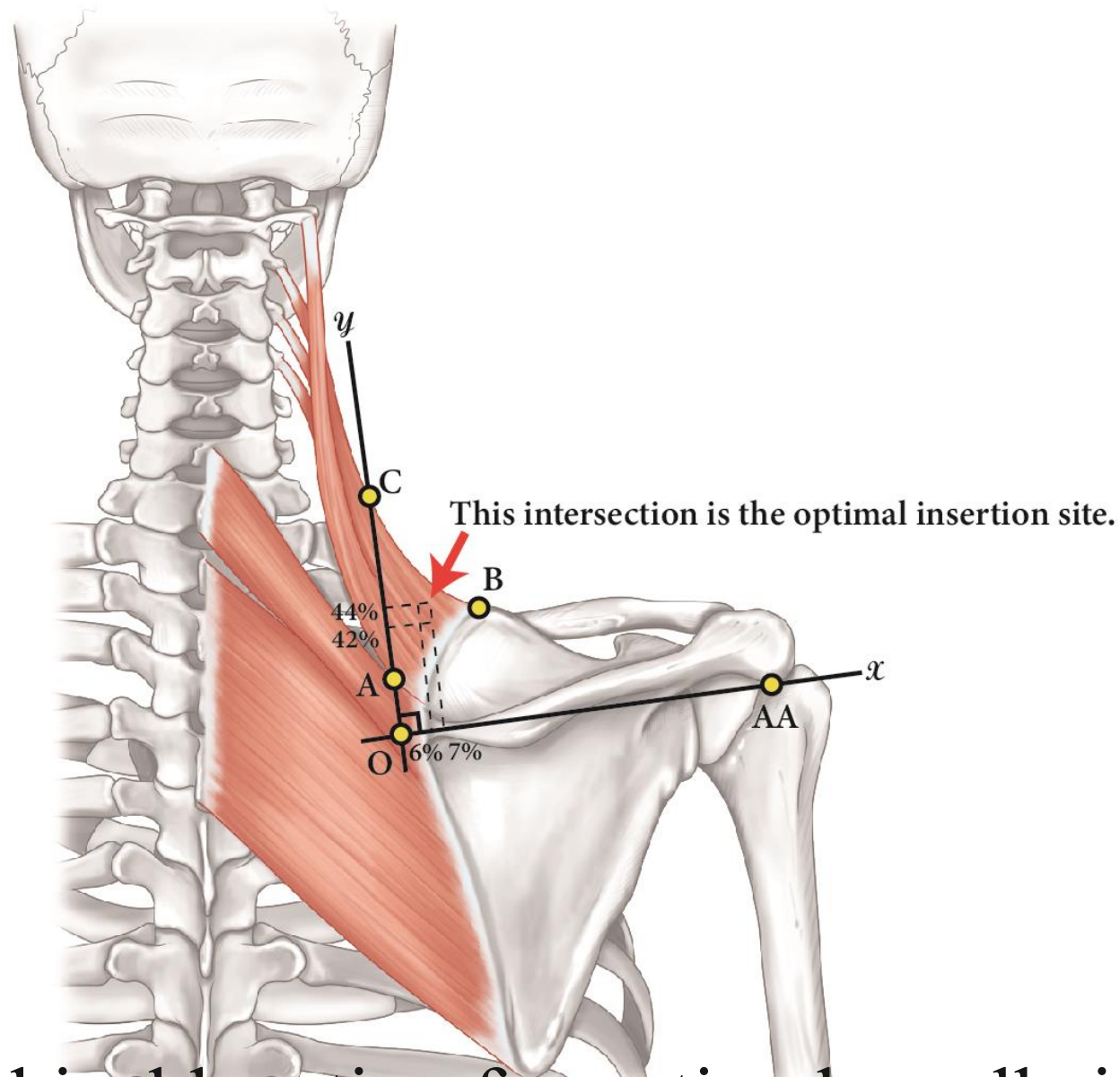


FIGURE 2 Topographical location for optimal needle insertion into the levator scapulae muscle.