

Supraclavicular Block in the Obese Population: An Analysis of 2020 Blocks

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Regional anesthesia in the obese patient can be challenging and possibly carries a greater failure rate as compared with that in the non-obese patient. We retrospectively reviewed our prospectively gathered peripheral block data to determine the influence of body weight on success rate of the supraclavicular block. Obesity was defined as body mass index ≥ 30 . The overall success rate was 97.3% in nonobese and 94.3% in

obese patients ($P < 0.01$). Residents completed 80% of the blocks in nonobese patients and 73% in obese patients ($P < 0.01$). No difference in acute complications was observed. Obesity is associated with a slight decrease in success rate of supraclavicular block and an increase in its relative difficulty without apparent effect on acute complications.

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Obesity in the United States has reached epidemic proportions (1). Management of these patients can be challenging because obesity can be associated with difficult airway, frequent coexisting medical conditions, and landmarks that are difficult to determine (2-4). Regional anesthesia in the obese patient can also be associated with less success (4-8).

We decided to investigate the impact of body mass index (BMI) on the success rate of supraclavicular block, our technique of choice for surgery on the upper extremity that does not involve the shoulder. Ours being a teaching institution, we also wanted to know whether obesity had any impact on the resident's ability to perform this technique.

Methods

After institutional ethics committee approval, we retrospectively reviewed our prospectively gathered data on peripheral nerve blocks to identify every consecutive

supraclavicular block used for anesthesia between February 1996 and April 2003. Our database contains demographic and technical information entered contemporaneously with every case according to a preestablished protocol. The type of response elicited with the nerve stimulator was added to the original protocol a few months after the database was started; thus, it was present in 1732 of 2020 cases (86%), being the only data in the protocol not available in 100% of the cases. No supraclavicular block performed for surgical anesthesia was excluded for any reason.

We chose to use the definition for obesity used by many national and international organizations (1). A BMI of 30 was used to separate obese from non-obese groups. When indicated, the following subgroups were recognized: underweight BMI, $< 18.5 \text{ kg/m}^2$; normal BMI, $18.5\text{--}24.9 \text{ kg/m}^2$; overweight BMI, $25.0\text{--}29.9 \text{ kg/m}^2$; obesity BMI, $30.0\text{--}39.9 \text{ kg/m}^2$; and morbid obesity BMI, $\geq 40 \text{ kg/m}^2$.

We graded our block results in the following manner: good = sensory block of the upper extremity distal to the shoulder developed within 30 min from the injection or before surgical incision (if it took place earlier) and was the only anesthetic used for the surgical procedure; partial = local anesthetic supplementation was required at some point, either by the surgeon or anesthesiologist; and failure = general anesthesia was required.

Responses were grouped into 'fingers' (flexion or extension), 'wrist' (flexion or extension), and 'other.' This last group included supination and pronation.

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Table 1. Group and Subgroup Demographics

	Non-obese group and subgroups				Obese group and subgroups		
	Non-obese overall ^a	UW ^b	N ^b	OW ^b	Obese overall ^a	O ^b	MO ^b
Age (yr)	35 ± 13	35 ± 17	34 ± 13	37 ± 13*	39 ± 14 [†]	39 ± 14*	41 ± 1*
Height (cm)	172 ± 10	174 ± 13	172 ± 10	171 ± 10	170 ± 11 [†]	170 ± 11*	166 ± 10*
Weight (kg)	72 ± 12	53 ± 9*	66 ± 9*	79 ± 10*	99 ± 17 [†]	95 ± 14*	122 ± 20*
BMI (kg/m ²)	24 ± 3	17 ± 1*	22 ± 2*	27 ± 1*	34 ± 5 [†]	33 ± 3*	44 ± 4*
Male (%)	74	64	73	75	60 [†]	64*	27*
Total (n)	1565	44	758	763	455	403	52

Values other than percentages are expressed as mean ± sd.
BMI = body mass index.

^aThere are two groups: non-obese with BMI < 30 and obese with BMI ≥ 30. ^bThere are three non-obese subgroups: underweight (UW: BMI < 18.5); normal (N: BMI 18.5-24.9), and overweight (OW: BMI 25-29.9); and two obese subgroups: obese (O: BMI 30-39.9) and morbidly obese (MO: BMI ≥ 40).

*P < 0.01 individual subgroup versus the non-obese group; [†]P < 0.01 obese group versus non-obese group.

Table 2. Success Rates Among BMI Groups and Subgroups

	Non-obese group and subgroups					Obese group and subgroups		
	Overall	Non-obese overall ^a	UW ^b	N ^b	OW ^b	Obese overall ^a	O ^b	MO ^b
Good, n (%)	1951 (96.6)	1522 (97.3)	44 (100)	738 (97.4)	740 (97.0)	429 (94.3) [†]	381 (94.5)*	48 (92.3)
Partial, n (%)	33 (1.6)	19 (1.2)	0	12 (1.6)	7 (0.9)	14 (3.1) [†]	12 (3.0) [‡]	2 (3.8)
Failure, n (%)	36 (1.8)	24 (1.5)	0	8 (1.1)	16 (2.1)	12 (2.6)	10 (2.5)	2 (3.8)
Accidental paresthesia, n (%)	49 (2.4)	34 (2.2)	2 (4.5)	13 (1.7)	19 (2.5)	15 (3.3)	10 (2.5)	5 (9.6)*
Blocks started by residents, n (%)	1586 (78.5)	1235 (78.9)	35 (79.5)	603 (79.6)	597 (78.2)	351 (77.1)	315 (78.2)	36 (69.2)
Blocks completed by residents, n (%)	1249 (78.8)	993 (80.4)	31 (88.6)	498 (82.6)	464 (77.7)	256 (72.9) [†]	231 (73.3)*	25 (69.4)

BMI = body mass index.

^aThere are two groups: non-obese with BMI < 30 and obese with BMI ≥ 30.

^bThere are three non-obese subgroups: underweight (UW: BMI < 18.5); normal (N: BMI 18.5-24.9), and overweight (OW: BMI 25-29.9); and two obese subgroups: obese (O: BMI 30-39.9) and morbidly obese (MO: BMI ≥ 40).

*P < 0.01 individual subgroup versus the non-obese group; [†]P < 0.01 obese group versus non-obese group; [‡]P < 0.05 individual subgroup versus the non-obese group.

All blocks were performed according to the technique previously described (9) using a nerve stimulator (Stimuplex DIG, B. Braun, Bethlehem, PA) and a 22-gauge, 5-cm, insulated needle (Stimuplex, B. Braun). We used 35-40 mL of 1.5% mepivacaine plus 1: 200,000 epinephrine after elicitation of a motor response of flexion or extension in all fingers at 0.8 mA without decreasing the current before the injection (10). For longer procedures, lyophilized tetracaine was added to the mepivacaine solution for a final concentration of 0.2% tetracaine (80 mg total). Residents were given approximately 10 min under faculty supervision to complete the technique before the supervisor took charge. This fact is reflected on resident completion rate in the results.

Statistical calculations were performed using the Statistical Package for the Social Sciences (SPSS, version 12; SPSS Inc., Chicago, IL) and Medcalc Software (Mariakerke, Belgium). Statistical comparisons were performed between the large non-obese (BMI < 30) and obese (BMI ≥ 30) groups. A P value of ≤ 0.05 was considered statistically significant. For continuous

variables, we used unpaired t-tests to calculate two-tailed P values. For categorical variables, we used χ^2 with Yates correction tests to compare two proportions. The comparison among subgroups containing data expressed as mean ± sd was performed using Tukey-Kramer multiple comparison tests. Data expressed in percentage, as success rate and type of response, were analyzed making individual comparisons of each subgroup with the non-obese group.

Results

We performed 1565 blocks (77.5%) on non-obese patients and 455 blocks (22.5%) on obese patients. Table 1 shows demographics of the groups and subgroups.

The success rate was 96.6% overall, 97.3% in the non-obese population, and 94.3% in the obese patients (P < 0.01) (Table 2). The non-obese group had significantly more good or partial blocks compared with the obese group (P < 0.01). Good and partial blocks were also more frequent in the non-obese group compared

Table 3. Type of Response Elicited in BMI Groups and Subgroups

Response	Non-obese group and subgroups				Obese groups and subgroups			
	Overall	Non-obese overall ^a	UW ^b	N ^b	OW ^b	Obese overall ^a	O ^b	MO ^b
Fingers, <i>n</i> (%)	1454 (84.0)	1150 (85.7)	27 (84.4)	574 (87.4)	549 (84.1)	304 (77.9)†	272 (79.3)*	32 (68.1)*
Wrist, <i>n</i> (%)	234 (13.5)	165 (12.3)	5 (15.6)	70 (10.7)	90 (13.8)	69 (17.7)†	58 (16.9)*	11 (23.4)§
Other, <i>n</i> (%)	44 (2.5)	27 (2.0)	0 (0)	13 (1.9)	14 (2.1)	17 (4.4)‡	13 (3.8)§	4 (8.5)*
Total (<i>n</i>)	1732	1342	32	657	653	390	343	47

BMI = body mass index.

^aThere are two groups: non-obese with BMI < 30 and obese with BMI ≥ 30.

^bThere are three non-obese subgroups: underweight (UW: BMI < 18.5); normal (N: BMI 18.5–24.9), and overweight (OW: BMI 25–29.9); and two obese subgroups: obese (O: BMI 30–39.9) and morbidly obese (MO: BMI ≥ 40).

* $P \leq 0.01$ individual subgroup versus the non-obese group; † $P < 0.01$ obese group versus non-obese group; ‡ $P < 0.05$ obese group versus the non-obese group; § $P < 0.05$ individual subgroup versus non-obese group.

with the obese subgroup ($P < 0.01$ and $P < 0.05$, respectively). In addition, compared with the non-obese group overall, accidental paresthesias were more frequent in the morbidly obese subgroup, and the resident completion rate was less in the obese subgroup ($P < 0.01$).

The type of response elicited with the nerve stimulator was available in 1732 of 2020 cases (86%). The ability to elicit a response in all fingers (our ideal response) decreased from 87% in the normal weight population to 68% in the morbidly obese patients (Table 3).

Finally, fingers and wrist responses were followed by 98.1% and 97.4% successful blocks, respectively ($P = 0.65$), whereas the combination of other responses produced only a 61.4% success rate ($P < 0.01$). We had two cases of seizures: one on a normal weight female patient and another on an overweight male patient. No evidence of pneumothorax was found.

Discussion

This large review of our prospectively gathered data shows that obesity increases the difficulty and decreases the success rate of a supraclavicular block. The increase in difficulty is evidenced by a decrease in the rate of block completion by residents and by a decrease in our ability to elicit an 'ideal' fingers response (10,11). However, this relative increase in difficulty did not prevent the residents from successfully completing approximately 70% of the blocks in the morbidly obese patients.

Moreover, the impact of obesity on success rate of a supraclavicular block was small considering that, overall, the block was still 94% successful among the obese group. Our results support the clinical impression that the fingers response to nerve stimulation is an ideal response for supraclavicular block and that wrist response might be as good.

The rate of acute complications was minimal and did not differ among populations. A recent study by Nielsen et al. (4) reported a 0.3% overall rate of acute

complications. We have never documented a pneumothorax with a supraclavicular technique in an experience spanning more than 11 years. Phrenic nerve blockade reportedly occurs less often than after an interscalene approach, and it is not associated with respiratory difficulty in healthy volunteers (12). Our clinical experience does not indicate clinical evidence of respiratory compromise in any kind of patient.

In conclusion, these results demonstrate that supraclavicular block may be successfully performed in the obese patient and is associated with few complications.

References

- Bjorntorp P. Definition and classification of obesity. In: Fairburn CG, Brownell KD, eds. Eating disorders and obesity. 2nd ed. New York: The Guilford Press, 2002:377–81.
- Buckley FP. Anesthesia and obesity and gastrointestinal disorders. In: Barash PG, Cullen BF, Stoelting RK, eds. Clinical anesthesia. 3rd ed. Philadelphia: Lippincott-Raven, 1997:975–89.
- Roizen MF. Anesthetic implications of concurrent diseases. In: Miller RD, ed. Anesthesia. 5th ed. Philadelphia: Churchill Livingstone, 2000:903–1015.
- Nielsen K, Guller U, Steele S, et al. Influence of obesity on surgical regional anesthesia in the ambulatory setting: an analysis of 9,038 blocks. *Anesthesiology* 2005;102:181–7.
- Fisher A, Waterhouse TD, Adams AP. Obesity: its relation to anaesthesia. *Anaesthesia* 1975;24:208–16.
- Greengrass R, Steele S, Moretti G. Peripheral nerve blocks. In: Raj PP, ed. Textbook of regional anesthesia. New York: Churchill Livingstone, 2002:325–77.
- Vincent RD, Chestnut DH. Analgesia during labor and delivery. In: Brown DL, ed. Regional anesthesia and analgesia. Philadelphia: W.B. Saunders Company, 1996:587–608.
- Leith P, Sanborn R, Brock-Utne JG. Intraoperative epidural catheter malfunction in two obese patients. *Acta Anaesthesiol Scand* 1997;41:651–3.
- Franco CD. The subclavian perivascular block. *Tech Reg Anesth* 1999;3:212–6.
- Franco CD, Domashevich V, Voronov G, et al. The supraclavicular block with a nerve stimulator: to decrease or not to decrease, that is the question. *Anesth Analg* 2004;98:1167–71.
- Franco CD, Vieira ZÉ. 1,001 subclavian perivascular brachial plexus blocks: success with a nerve stimulator. *Reg Anesth Pain Med* 2000;25:41–6.
- Neal JM, Moore JM, Kopacz DJ, et al. Quantitative analysis of respiratory, motor, and sensory function after supraclavicular block. *Anesth Analg* 1998;86:1239–44.