Extrafascial catheter tip placement for continous interscalene brachial plexus block reduces hemidiaphragmatic paresis compared with a conventional intrafascial tip placement: a randomized controlled, double-blind trial

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Introduction

The rate of hemidiaphragmatic paresis at 24h postoperatively after continuous interscalene brachial plexus block (CISB) is reported to be as high as 71%. We tested the hypothesis that an extrafascial placement of the catheter tip would reduce the rate of hemidiaphragmatic paresis compared to intrafascial tip placement for CISB while providing effective analgesia.

Methods

Seventy patients scheduled for elective major shoulder surgery were randomised to receive an ultrasound-guided CISB plexus block for analgesia, with a catheter tip placed between the levels of C5 and C6 and either within (intrafascial group) or outwith (extrafascial group) the brachial plexus sheath. Catheters were bolused with 20mL ropivacaine 0.5% followed by a 4ml.h⁻¹ infusion rate of ropivacaine 0.2%. The primary outcome was rate of hemidiaphragmatic paresis (diaphragmatic excursion reduction >75%), measured by M-mode ultrasonography, before and 24h after the procedure. Secondary outcomes included rate of rate of hemidiaphragmatic paresis in phase 1 recovery and at 24h posoperatively; forced vital capacity, forced expiratory volume in 1 second and peak expiratory flow in phase 1 recovery, on postoperative day 1 and 2; and pain score at rest (numeric rating scale, 0-10) and intravenous morphine equivalent consumption at 24h postoperatively.

Figure 1. Rates of hemidiaphragmatic paresis in phase 1 recovery, and on postoperative (PO) days 1 and 2. Data are expressed as percentage with 95% confidence interval.

Results

The rate of hemidiaphragmatic paresis at 24h postoperatively was significantly reduced in the extrafascial group (intrafascial: 41%[95%CI:25-59%]; extrafascial: 15%[95%CI: 5-32%];p=0.01; figure 1), while other respiratory functional outcomes were similar (table 1). At 24h postoperatively, we found no differences in pain scores at rest (intrafascial: 3[95%CI: 2-3];extrafascial:3[95%CI: 2-4];p=0.93), or cumulative intravenous morphine equivalent consumption (intrafascial:7[95%CI: 5-9];extrafascial:6[95%CI: 3-9];p=0.75).

Conclusion

Placement of the catheter tip immediately outside of the brachial plexus sheath reduces the rate of hemidiaphragmatic paresis associated with US-guided CISB on postoperative day 1 while providing effective analgesia following major shoulder surgery. Our results do not support the routine placement of the catheter tip within the brachial plexus sheath.

Table 1. Functional respiratory outcomes. Data are presented as mean and 95% confidence interval.

	Intrafascial group	Extrafascial group	p value
Phase 1 recovery			
Forced vital capacity (L)	2.1 (1.8 – 2.3)	2.2 (1.9 – 2.4)	0.44
Forced expiratory volume in 1 second (L)	1.6 (1.4 – 1.8)	1.7 (1.5 – 1.9)	0.50
Peak expiratory flow (L.s ⁻¹)	3.8 (3.3 – 4.3)	4.1 (3.4 – 4.7)	0.51
Percentage reduction from baseline value			
Forced vital capacity (%)	36% (33 – 40%)	31% (25 – 36%)	0.09
Forced expiratory volume in 1 second (%)	35% (29 – 39%)	29% (22 – 34%)	0.16
Peak expiratory flow (%)	32% (25 – 39%)	27% (18 – 37%)	0.43
Postoperative day 1			
Forced vital capacity (L)	2.3 (2.0 – 2.6)	2.5 (2.1 – 2.8)	0.53
Forced expiratory volume in 1 second (L)	1.8 (1.6 – 2.1)	1.9 (1.7 – 2.2)	0.57
Peak expiratory flow (L.s ⁻¹)	4.8 (4.1 – 5.6)	4.7 (4.0 – 5.5)	0.84
Percentage reduction from baseline value			
Forced vital capacity (%)	29% (22 – 36%)	23% (17 – 28%)	0.15
Forced expiratory volume in 1 second (%)	29% (23 – 36%)	22% (17 – 28%)	0.12
Peak expiratory flow (%)	20% (12 – 29%)	20% (12 – 27%)	0.87
Postoperative day 2			
Forced vital capacity (L)	2.6 (2.2 – 3.0)	2.8 (2.4 – 3.1)	0.44
Forced expiratory volume in 1 second (L)	1.9 (1.6 – 2.3)	2.1 (1.8 – 2.4)	0.45
Peak expiratory flow (L.s ⁻¹)	4.8 (4.0 – 5.6)	5.0 (4.2 – 5.7)	0.73
Percentage reduction from baseline value			
Forced vital capacity (%)	25% (16 – 35%)	18% (9 – 28%)	0.29
Forced expiratory volume in 1 second (%)	27% (18 – 37%)	19% (9 – 29%)	0.23
Peak expiratory flow (%)	22% (11 – 33%)	19% (7 – 31%)	0.70

References

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