

Cervical Plexus Anesthesia in Carotid Surgery: A Retrospective Cohort Study

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Introduction

Patients undergoing carotid surgery remain a challenge in anesthesiologic management, mainly due to patients’ characteristics and surgical procedures. Analyzing outcomes from various multicenter trials has not shown any significant difference between the use of regional anesthesia (RA), general anesthesia (GA) or a combination thereof. However, anesthetic techniques used for surgery on the carotid artery are freely chosen by the providers. Therefore, a corresponding bias influencing the decision and its results cannot be ruled out. We aimed to answer two main research questions: first, does a significant difference in hemodynamic stability between RA and GA procedures exist and is there a difference in mortality between the two procedures?

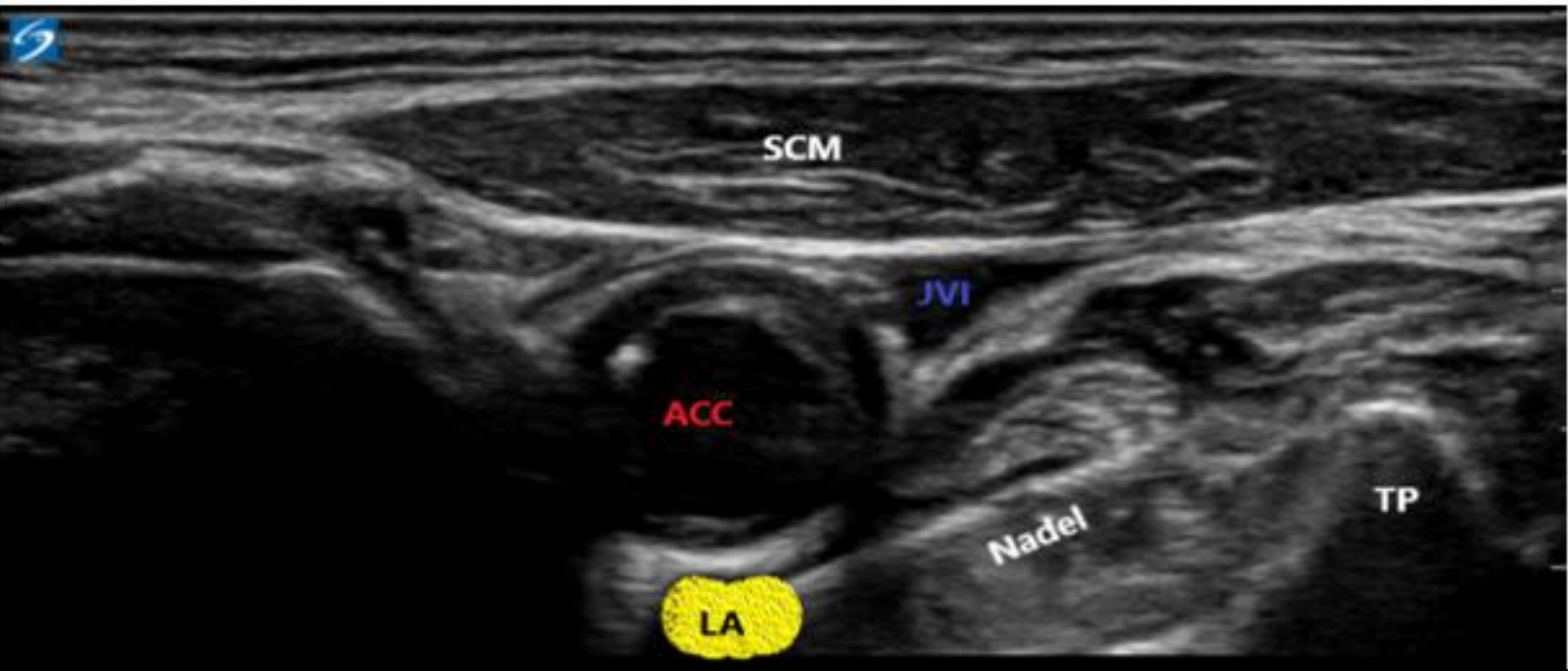
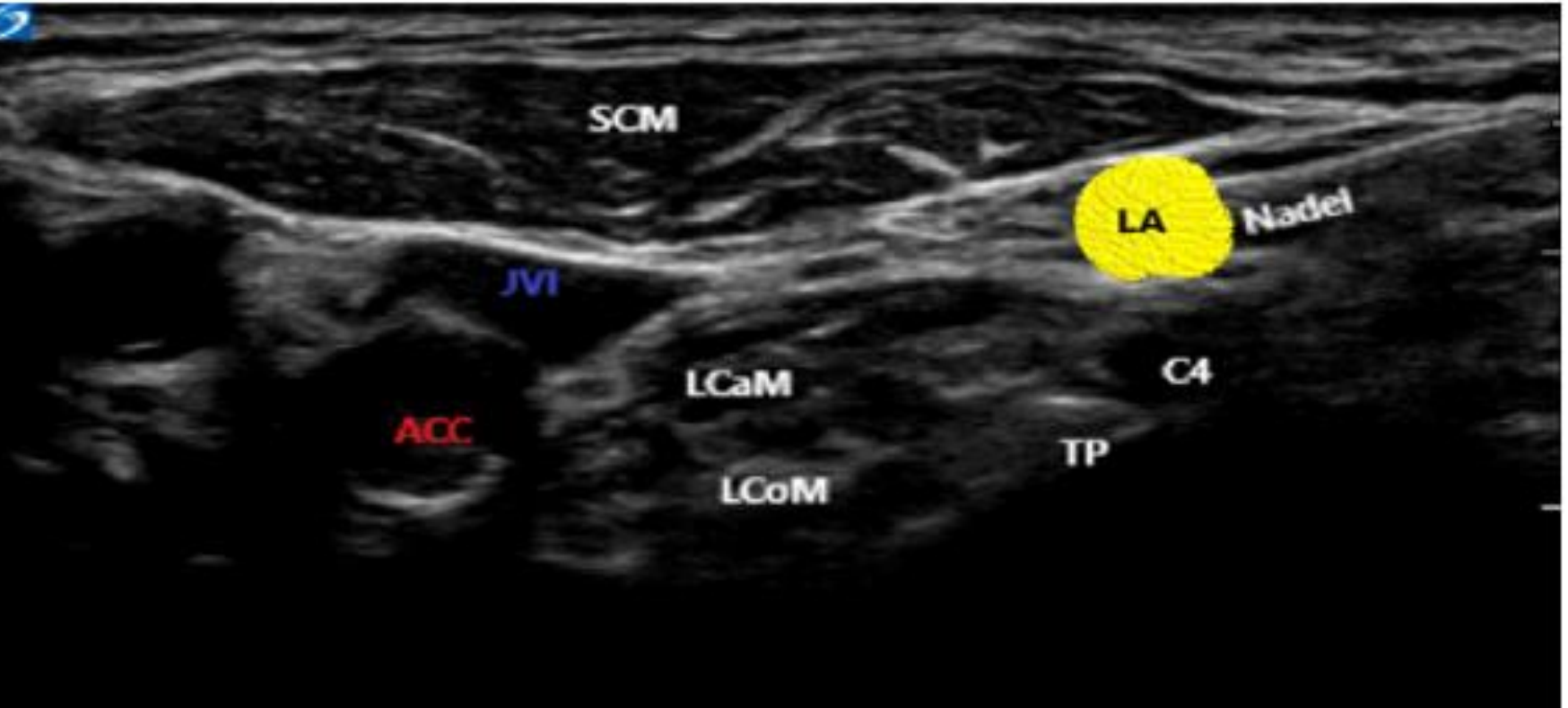


Figure 1-3: intermediate, profound and vascular sheath block. LA local anesthetic, ACC common carotid artery, JVI internal jugular vein, Nadel needle, TP transverse process.

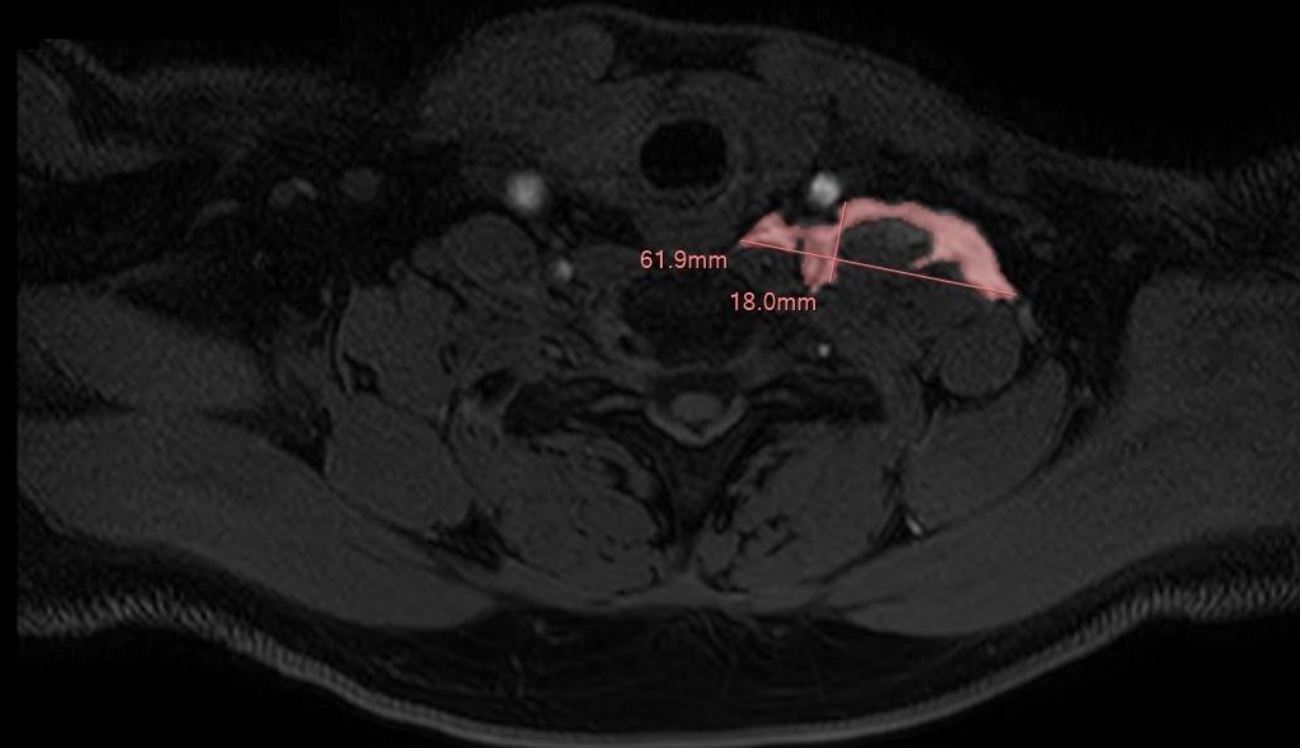
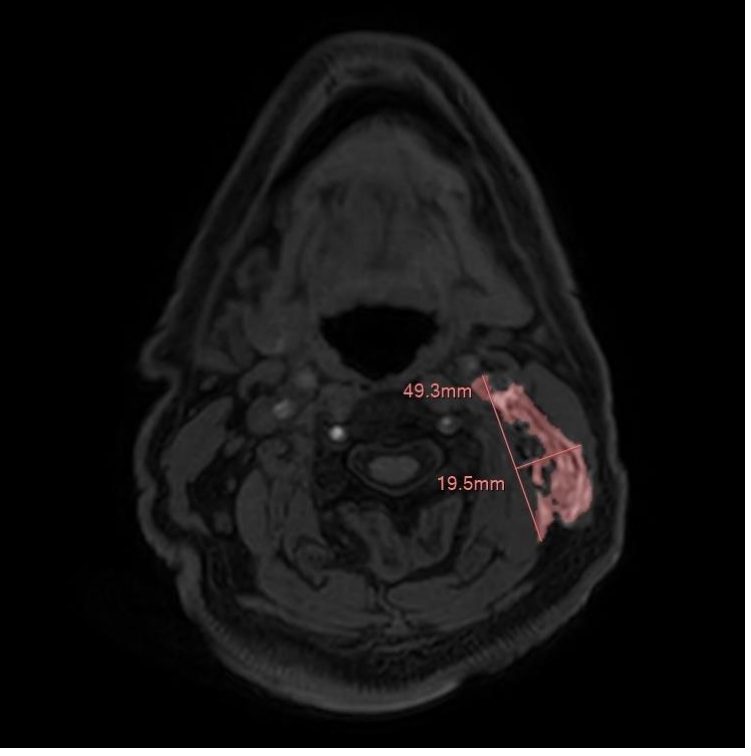
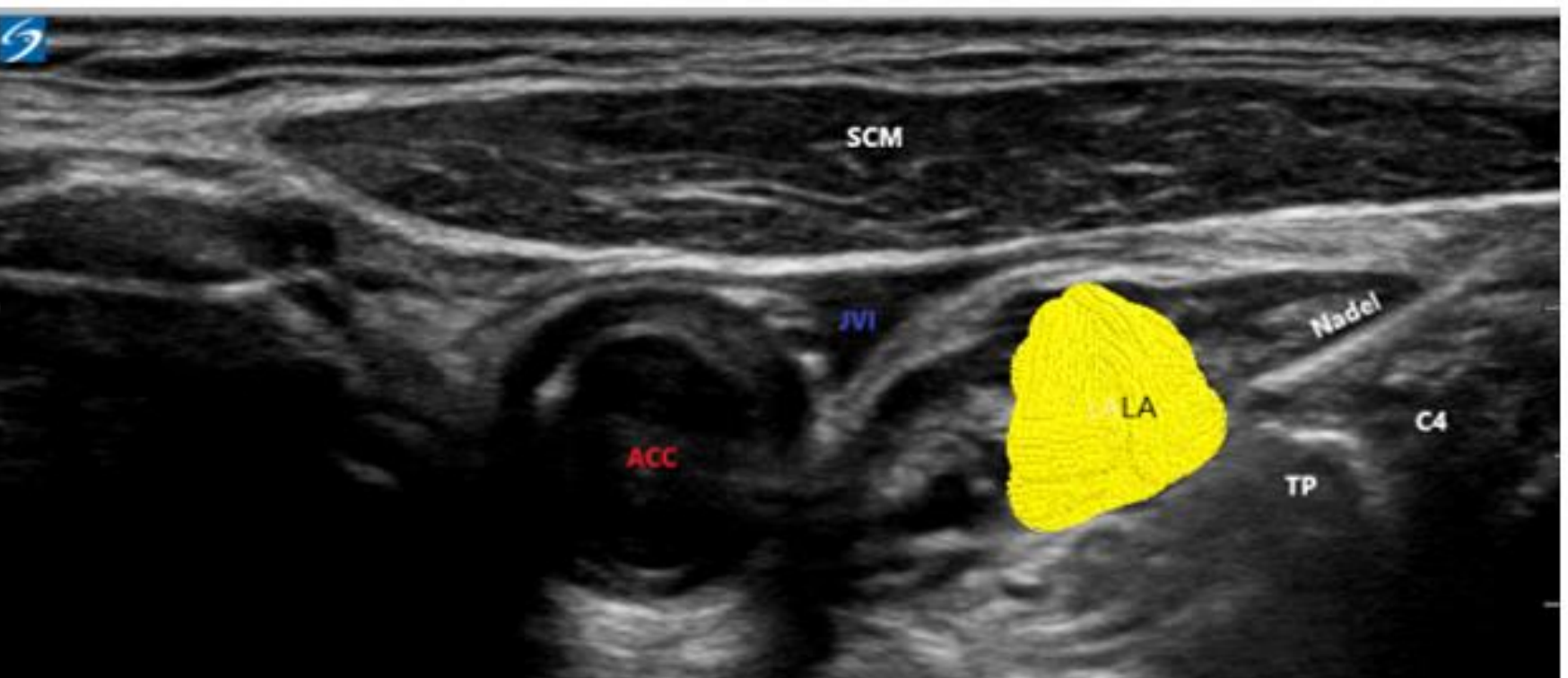


Figure 4 and 5: Local anesthetic distribution (red) via MRI for the intermediate and profound block, respectively.

Methods

The present study was conducted as a retrospective cohort analysis, all patients (SalzburgIntensiveCare Database (SICdb)), who underwent carotid surgery (ICD-10-GM I65.2) between 2012 and 2021, were included. A total of 634 procedures was identified. The study population was divided in two groups (GA (n=41) vs RA (n=539). The univariate analysis was conducted according to the normal distribution and type of data (continuous, categorical, binary) using either Student's t-test for 2 samples, Mann-Whitney U test, Pearson's chi-square test, or Wilcoxon rank sum test. To assess the correlations of secondary variables with the primary endpoint, a pairwise Pearson correlation was performed for the different. The coefficient and significance (p<0.01) were reported following a Bonferroni correction for multiple testing. A multiple linear regression was conducted with the significant parameters from the univariate analysis: type of anesthesia, patient age, ICU days, diabetes, lung disease, kidney disease, diuretic use, SAPS3-score, baseline creatinine, and administered fluid volume for the endpoint of 1-year-mortality. A Kaplan-Meier survival curve was calculated between the groups of anesthesia type and the event of mortality within 365 days. A Cox regression analysis was applied to this hazard model using the independent variables already used in the logistic regression analyses as a sensitivity analysis.

Results

593 carotid surgeries were performed under RA and 41 under GA during the study period. The hemodynamic stability between the groups was considered comparable, with a higher norepinephrine and volume requirement observed in the GA group. The 1-year mortality differed significantly with 3.4% vs. 9.8% (for RA vs. GA, p<0.05), but multivariate regression analysis could no longer demonstrate this significance due to other variables (age, diabetes, lung disease, SAPS3-score, volume, creatinine) that reflect the indication and comorbidities.

Conclusion

Carotid surgery and its care are standardized procedures at appropriate centers with internationally similar mortality rates, with the choice of anesthesia method appearing negligible in terms of hemodynamic stability and mortality. Regarding the primary endpoint – the 1-year mortality – statistical significance was achieved in the univariate analysis; however, this could no longer be demonstrated in the regression analyses after adjusting for additional covariates. This most likely indicates an indication bias, where general anesthesia is primarily used for urgent or complicated procedures in a center that heavily emphasizes regional anesthesia. More detailed investigations into neurological monitoring procedures, pain, and patient satisfaction are still needed.

Table 1: logistic multivariate regression model (1-year mortality)

1-year mortality	coeff	StdF	t-value	p-value	[95% CI]		sig
Regional anesthesia	1	.	.	.	.	.	.
General anesthesia	0.673	0.604	-0.44	0.659	0.116	3.908	.
Age	1.071	0.036	2.03	0.042	1.002	1.144	**
ICU (days)	0.848	0.162	-0.86	0.39	0.583	1.234	.
Diabetes (no)	1	.	.	.	.	.	.
(yes)	2.694	1.293	2.07	0.039	1.052	6.899	**
Pulmonary disease (no)	1	.	.	.	.	.	.
(yes)	3.032	1.643	2.05	0.041	1.048	8.772	**
Renal disease (no)	1	.	.	.	.	.	.
(yes)	1.403	0.812	0.58	0.559	0.451	4.362	.
Diuretics (no)	1	.	.	.	.	.	.
(yes)	2.111	1.036	1.52	0.128	0.807	5.522	.
SAPS3 Score	1.072	0.033	2.28	0.023	1.010	1.139	**
Creatinin	1.502	0.351	1.74	0.082	0.950	2.375	*
Volume	1.001	0.000	2.77	0.006	1.000	1.001	***
Konstante	0.000	0.000	-5.17	0.000	0.000	0.000	***
*** p<0.01, ** p<0.05, * p<0.1, coeff = coefficient, SE = Standard error, sig = significance, MW = mean, SD = standard deviation, # = number							

Table 2: Cox regression analysis

# patients	630		# observations	630	
# episodes	24				
Time at risk	225,099.24				
			LR chi2(10) =	48.88	
log	-129.81421		prob > chi2 =	0.000	
Endpoint mortality	HR	SE	z	P > z	[95% CI]
General Anesthesia	0.57562	0.46701	-0.68	0.496	0.11737 2.8231
Age	1.06118	0.03157	2.00	0.046	1.00108 1.1249
ICU (days)	0.84539	0.13327	-1.07	0.287	0.62068 1.1515
Diabetes	2.57512	1.13035	2.15	0.031	1.08934 6.0874
Pulmonary disease	2.99933	1.45828	2.26	0.024	1.15656 7.7782
Renal disease	1.37698	0.73443	0.60	0.549	0.48409 3.9167
Diuretics	1.91979	0.90173	1.39	0.165	0.76461 4.8202
SAPS3 Score	1.07941	0.03044	2.71	0.007	1.02137 1.1407
Creatinin	1.45100	0.27510	1.96	0.050	1.00067 2.1040
Volume	1.00045	0.00016	2.88	0.004	1.00015 1.0008
# = number of, HR = hazard ratio, SE = standard error					