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Original Article

Comparison of general versus isolated regional anesthesia in total shoulder arthroplasty: A retrospective propensity-matched cohort analysis

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ABSTRACT

Background: Intraoperative anesthetic typically consists of either general anesthesia (GA) or isolated regional anesthesia (RA).

Methods: A retrospective propensity-matched cohort analysis on patients undergoing TSA was performed to determine differences between GA and RA in regard to patient population, complications, LOS and hospital readmission.

Results: 4158 patients underwent TSA with GA or isolated RA. Propensity-matching resulted in 912 patients in each cohort. RA had lower overall in-hospital complications and greater homebound discharge disposition with lower 90-day readmission rates than GA.

Conclusion: After TSA, isolated RA was associated with lower in-hospital complications, readmission rates and odds of hospital readmission than GA.

1. Introduction

Total shoulder arthroplasty (TSA) is the long-term standard of care to relieve pain and restore function for multiple pathologies such as osteoarthritis,[1–4] rheumatoid arthritis,[5,6] trauma,[7] and osteonecrosis.[8,9] When conservative management such as analgesics, physiotherapy and local cortisone injections fail, TSA reliably relieves pain and restores function.[3,10,11] While techniques and implants may vary between surgeons, patients are typically anesthetized using two methods: general anesthesia (GA) with or without regional blockade and isolated regional anesthesia (RA).

GA is the most common form of anesthesia and has numerous merits. GA provides intraoperative amnesia, resulting in decreased patient awareness and recall,[12] and can be continuously administered during surgery without the patient moving. Lastly, the effects of GA can be easily prolonged or reversed if required, thus allowing appropriate adaptation during procedures of unpredictable duration. Despite these advantages however, GA by itself is inadequate at providing local pain control in the immediate post-operative period.[13] Furthermore, because GA suppresses normal autonomic functions (including breathing and cardiac responses),[14] an anesthesiologist must be vigilant in monitoring patient vitals and controlling breathing through an endotracheal device. Previous authors have suggested that cerebral hypoperfusion is potentiated by inhalational agents used in GA,[15] and a clinical trial by Koh et al. found that cerebral deoxygenation events were significantly more likely with GA as compared to isolated RA.[16] Other side effects of GA are equally serious and include aspiration, short-term amnesia, nausea, vomiting, pruritis, and hoarseness.[14,17]

RA is an effective anesthesia and analgesic technique for patients undergoing shoulder surgery.[18,19] Typically, RA involves brachial plexus blockade from various anatomic approaches (interscalene, supraclavicular, infraclavicular). Utilization of RA was reported as early as 1929 by Strode in the treatment of upper extremity fractures, and its application can be traced as early as the late 1800s.[20] In addition to providing excellent intraoperative pain control, touted advantages of RA include improved postoperative pain control, decreased opioid use, and reduced recovery times compared to GA.[21,22] Additionally, autonomic functions are preserved during RA, allowing the patient to regulate their own vital functions. Finally, several authors have reported on the

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efficacy of brachial plexus blockade in shoulder surgery in providing excellent muscle relaxation, greater hemodynamic stability, reduced PACU stay, decreased unplanned hospital readmission for pain control, increased operating room efficacy and greater patient satisfaction.[23,17,14,24] Limitations of RA include the inability to perform intraoperative nerve monitoring, damage to vascular structures, and the potential for significant nerve palsy if improper technique is used.[25,26]

While authors have agreed that isolated RA reduces time to discharge for patients undergoing ambulatory surgeries such as shoulder arthroscopy,[27,28] no study has examined the impact of RA in the setting of TSA. In parallel with the rapidly accelerating utilization of TSA,[29,30] healthcare continues to grow increasingly focused on quality, with reimbursements becoming more closely tied to outcomes.[31] Thus, it becomes important to understand the role that anesthesia has in relation to hospital LOS, discharge disposition, in-hospital complications and readmission rates.

To appropriately answer these questions and assess the impact of GA versus isolated RA in the setting of elective TSA, we used a large inpatient database to perform a retrospective propensity-matched cohort analysis. Based on existing orthopaedic literature,[32,33] we hypothesized that isolated RA would be associated with lower rates of in-hospital perioperative complications, shorter LOS, lower readmission rates and greater homebound discharge as compared to GA.

2. Methods

New York Statewide Planning and Research Cooperative System (SPARCS) database was queried to identify patients eighteen and older who underwent elective inpatient TSA between 2011 and 2014. We began our study in the year 2011 as it was the earliest year available for which we could accurately differentiate between anatomic total shoulder (aTSA) and reverse total shoulder (rTSA) arthroplasty. Numerous peer-reviewed publications have used SPARCS for epidemiologic studies in orthopaedics.[34–37]

International Classification of Diseases (ICD-9) codes 81.80 and 81.88 were used to identify patients undergoing aTSA or rTSA, respectively. Demographic information regarding patient age, gender, race, and insurance were collected. Concomitant medical comorbidities were identified using the Elixhauser Comorbidity Criteria, which has been previously validated in orthopaedic database studies.[38] Overall comorbidity burden was stratified into four groups: 0, 1, 2, and 3 or more comorbidities. ICD-9 codes 305.1 and V15.62 were used to identify patients with a history of tobacco use.[39–41]

To best identify an elective cohort, patients with fracture-related diagnoses or those undergoing surgery for prior infection, tumor, or previous surgical complications were excluded. Primary diagnosis at time of initial arthroplasty was stratified into six groups: osteoarthritis, inflammatory arthritis, post-traumatic arthritis, cuff disorders, osteonecrosis, and miscellaneous arthritis. Matsen et al. used this methodology in a recent study that also used SPARCS database.[42] Similar to their study, any patient with an ICD-9 code (V43.61, V43.62, or V43.63) indicating the existence of a previous upper-extremity arthroplasty at time of index surgery was eliminated to avoid ambiguity regarding contralateral shoulder procedures and/or elbow or wrist arthroplasty.[42] Hospitals were stratified based on teaching status, urban or rural location, and bedsize: small (less than 200 beds), medium (200–400 beds), and large (greater than 400 beds).

Patients were stratified into two groups based on whether they received GA or isolated RA. The SPARCS database only records the single highest level of anesthesia provided, and thus patients who received general anesthesia at any point in the admission would only have a code for GA, regardless of whether they received concomitant regional blockade. Thus, patients who received GA without regional blockade and those who received GA with

Table 1
Unadjusted and propensity-matched baseline demographics between general and regional anesthesia.

	Type of Anesthesia			Type of Anesthesia		
	General 78.1% (3246) Mean (SD)	Regional 21.9% (912)	P value before matching	General 50% (912) Mean (SD)	Regional 50% (912)	P value after matching
Age	68.8 (9.8)	68.3 (9.9)	0.176	68.4 (9.7)	68.3 (9.8)	0.833
	% (n)			% (n)		
Age Subgroup						
Younger 55	8.1 (262)	7.9 (72)	0.651	7.8 (71)	7.9 (72)	0.586
55–65	23.0 (746)	24.3 (222)		24.3 (222)	24.3 (222)	
65–75	38.9 (1264)	39.1 (357)		38.6 (352)	39.1 (357)	
75–85	25.7 (834)	25.3 (231)		24.5 (223)	25.3 (231)	
85+	4.3 (140)	3.3 (30)		4.8 (44)	3.3 (30)	
Gender						
Male	43.8 (1421)	45.5 (415)	0.365	45.3 (413)	45.5 (415)	0.963
Female	56.2 (1825)	54.5 (497)		54.7 (499)	54.5 (497)	
Race						
Caucasian	87.7 (2845)	86.0 (784)	<**0.001**	87.0 (793)	86.0 (784)	0.941
Black	4.8 (156)	2.7 (25)		2.6 (24)	2.7 (25)	
Hispanic	2.2 (70)	2.6 (24)		2.4 (22)	2.6 (24)	
Other	5.4 (175)	8.7 (79)		8.0 (73)	8.7 (79)	
Insurance						
Medicare	65.0 (2110)	62.6 (571)	<**0.001**	64.3 (586)	62.6 (571)	0.581
Medicaid	2.5 (82)	1.2 (11)		0.8 (7)	1.2 (11)	
Private	24.5 (796)	32.5 (296)		30.5 (278)	32.5 (296)	
Work Comp	6.2 (200)	3.4 (31)		3.7 (34)	3.4 (31)	
Other	1.8 (58)	0.3 (3)		0.7 (7)	0.3 (3)	

Bold values indicate statistical significance which per our study was anything < 0.05