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at Thomas Jefferson University

**Peripheral Nerve Injury During
Shoulder Arthroplasty**

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Current Solutions in Shoulder & Elbow Surgery
Tampa, FL
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Disclosures

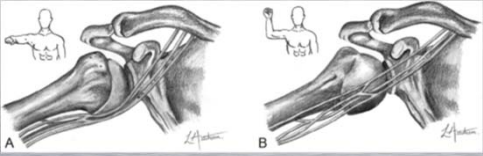
• **Joseph A. Abboud, MD**

- Depuy Synthes - Research Support
- Zimmer - Research support
- Tornier - Research Support, Paid Speaker
- Arthrex - Research Support
- OREF - Research support
- Wolters Kluwer Health - Lippincott Williams & Wilkins - Royalties
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- Cayenne - Royalties
- Minimvasive - Scientific Advisory Board
- OrthoSpace - Research support
- Aevumed - Stock
- Mid Atlantic Shoulder and Elbow Society - Board of Directors
- Globus - Royalties
- Parvizi Surgical Innovation - Stock
- Shoulder JAM LLC - Co-Founder
- OBERD
- Marlin Medical Alliance, LLC

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**What About Those
Nerves????**



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Audience Poll.... Show of Hands

- Do u do
- 1. < 25 arthroplasties/year
- 2. 25-50
- 3. 50-100
- 4. >100




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Same Show of hands

- Be honest
- 1. For those <25 have you had 1-5 nerve injuries/year?
- 2. For those 25-50 have you had 1-5 nerve injuries/year?
- 3. For those 50-100 have you had 1-5 nerve injuries/year?
- 4. For those > 100 have you had 1-5 nerve injuries/year?

- Anyone have more?




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Background

- **Neurological complications following shoulder surgery receive relatively little attention.**
- **Incidence of nerve injury cited ranging 0.6% - 21%.**



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Lynch & Cofield, 1996

- Represents, earliest report focusing on nerve complications after shoulder arthroplasty.
- Retrospectively identified nerve injury postoperatively in 18/417 shoulders (4.3%).

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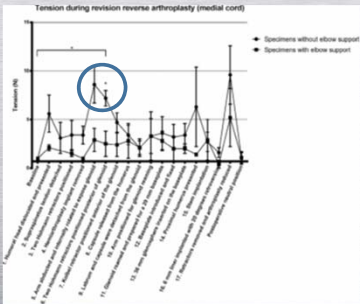
Why do you Think They Happen??



AUDIENCE PARTICIPATION TIME!

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Tension during revision reverse arthroplasty (medial cont)



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Lynch & Cofield, 1996

- Found majority of complications to be neuropraxic injuries to brachial plexus
- Likely from stretching and positioning of patient during surgery.
- True incidence may actually be higher, neurologic examination of post-op shoulder patient often limited by pain

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Neurologic complications of shoulder joint replacement
 Craig M. Ball, FRACS*

Department of Orthopaedic Surgery, Auckland City Hospital, Auckland, New Zealand

Background: Little attention has been given to neurologic complications after shoulder joint replacement (SJR). Procedures thought to cause neuropraxia, as it is likely that nerves are not clinically recognized, and they can result in postoperative morbidity and impact the patient's recovery. The purpose of this study was to document the prevalence of nerve complications after SJR, to identify the nerves involved, and to define patient outcomes.

Methods: This was a retrospective review of 211 SJR in 202 patients during a 5 year period from 2007 (female 99 male and 122 SJR) patients at an average age of 70 years. All patients underwent a comprehensive analysis of all postoperative nerve complications including neck, axilla, shoulder, hand/wrist, forearm, and ulnar nerve involvement.

Results: Of the 211 SJR procedures, 94 were identified as having neurologic complications (44.5%), with 16 female (36%) and 78 male patients (84.2%). Nerve SJR was associated with the replacement of nerve complications. The median age (22 years) and neuroanatomical zone (4 zones) from distal to proximal involved. Most nerve complications were transient and resolved within 6 months. Post-operative weakness and paresthesia that required secondary surgical intervention were rare.

Conclusions: The incidence of nerve complications after SJR is common and should be fully recognized. Most are transient neuropraxia involving the lateral cord of the brachial plexus. Weakness and sensory deficit in an arm patient who have undergone joint surgery to the affected shoulder. There are likely to be the result of excessive traction or direct injury to the nerve during glenoid exposure.

Level of Evidence: Level III Case Series (Retrospective Study)
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Keywords: Nerve dysfunction; shoulder joint replacement; reverse shoulder replacement; complication; median nerve; nerve recovery

Procedure	No.	%	Range	Resolution	%
Acromioclavicular SJR	65	30.8	12	20.0	30.8
Reverse SJR	146	69.2	27	18.5	12.6
Nonreversibly SJR	11	5.2	1	9.1	8.2
Resectable SJR	17	8.1	2	17.6	17.6

Our studies have not show anywhere near this rate of nerve injury, any correlation with revision or reverse, and Median nerve has not been most effected.

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Prevalence of Neurologic Lesions After Total Shoulder Arthroplasty

A. Lidemann, MD, A. Lubbeke, MD, DSc, B. Mlek, MD, R. Stern, MD,
P. Christoforidou, MD, G. Bick, MD, and G. Walch, MD

Investigation performed at the Division of Orthopaedics and Trauma Surgery, Department of Surgery, Geneva University Hospitals, Geneva, Switzerland, and the Department of Orthopaedic Surgery, Centre Orthopédique Saint-Louis, Paris

- EMG one week before and 3-4 weeks after shoulder arthroplasty




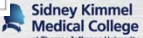



TABLE I Baseline Characteristics According to the Two Types of Shoulder Prostheses


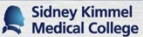
	Reverse Shoulder Arthroplasty (N = 19)	Anatomic Shoulder Arthroplasty (N = 23)
Sex* (no. of shoulders)		
Female†	15 (79)	16 (70)
Male	4 (21)	7 (30)
Age† (yr)	75.4 ± 6.6	70.8 ± 7.2
Side*		
Right	12 (63)	15 (65)
Left	7 (37)	8 (35)
Dominant shoulder*	12 (63)	14 (61)
Diagnosis*		
Primary osteoarthritis or rotator cuff arthropathy	15 (79)	22 (96)
Secondary osteoarthritis	4 (21)	1 (4)
Preop. neurologic lesion*		
Yes	9 (47)	13 (57)
No	10 (53)	10 (43)
Preop. Constant score† (points)	29.2 ± 12.1	33.9 ± 15.1

*The values are given as the number, with the percentage in parentheses. †One woman in the reverse shoulder arthroplasty group had bilateral involvement. ‡The values are given as the mean and the standard deviation.

Walch JBJS 2011


- 9/19 = 47% Reverse
- 1/23 = 4.3% TSA
- In hands of Master Surgeon
- Makes you wonder what the rates are in the hands of surgeons doing 1-5 arthroplasties per year?






Materials and Methods

- Primary outcome measure: post-operative clinically relevant neurologic injury
- Analysis done to determine if IONM alerts were indicative of post-operative peripheral nerve injury


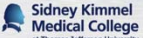
Average age (years)	68 (25-86)
Male (%)	4.9%
Diagnosis	
Glenohumeral osteoarthritis	366 (99%)
Rotator cuff tear arthropathy	69 (2%)
Post-traumatic acromioclavicular joint	29 (8%)
Other (osteosarcoma, fracture, infection)	17 (5%)
Arthroscopy status	15 (4%)
Surgery performed	
Anatomic total shoulder arthroplasty	176 (45%)
Reverse shoulder arthroplasty	76 (24%)
Revision arthroplasty	22 (7%)
Revision arthroscopy	14 (4%)




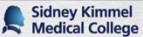
Results

- 2 post-operative transient nerve injuries (.7%)
 - Radial nerve (1), mixed brachial plexus (1)
 - Both occurred in anatomic arthroplasties
- All nerve injuries resolved within 1 year



Results

- 102 cases had MEP signals that reached alert threshold
 - 19 cases did not have MEP signals return above nerve alert threshold at closure
- Both injuries reported had MEP signals remain below the 80 % threshold at closure
- Failure of nerve signals to return above threshold associated with transient nerve injury (p = 0.03)
- All injuries occurred following primary anatomic total shoulder arthroplasty
- No difference in IONM rates of alert in primary and revision cases



Results

MEP Alert Criteria	#	True Positive	False Positive	True Negative	False Negative	Sensitivity	Specificity
80% reduction for all muscles	440	5	32	403	0	100%	92.6%
All-or-none for deltoid, 80% reduction for other muscles	232	1	2	229	0	100%	99.1%



Discussion

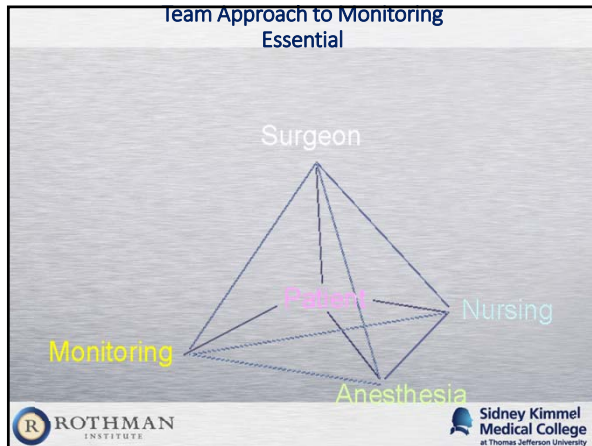
- IONM give surgeons real-time, dynamic information about a patient's neurological status just like any other intraoperative surrogate used
- Currently we continue to refine standards which will provide most accurate and reliable real time intraoperative data for peripheral nerve monitoring
- Use of an 80% threshold has decreased our rate of irrelevant intraoperative alerts without compromising patient safety
- Using 100% alert threshold in deltoid improved specificity without harming sensitivity

Discussion

- Intraoperative feedback may help the overall low rate of clinically relevant peripheral nerve injuries we report
- Surgical technique and decision making are still paramount
- No other surrogate data regarding peripheral nerve status is **currently readily available** intraoperatively



Debatable Points

- **Should there be a role for nerve monitoring in shoulder surgery?**
- **When?**
- **Patient Factors?**
- **Surgeon Factors?**
 - During the learning curve for some surgeons
 - Surgeries performed infrequently or with high complexity
 - May allow you to be more aggressive with dissections and releases particularly in revision settings

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Debatable Points



- **Legal ramifications?**
- **Financial ramification**
 - Cost per case is about \$800, DME are \$300-\$500
- **Is this technology over reason, or just the application of technology to further safeguard our patients?**
- **Think about the measures we take against infection?**
- **Are we doing enough to diagnose and prevent nerve injuries?**

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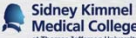
Debatable Points

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Debatable Points

- **As JP Warner asked, “What do we do with this data once it gets published?”**
 - Legal ramifications?
- **Financial ramification**
 - Cost per case is about \$800, DME are \$300-\$500
- **Is this technology over reason, or just the application of technology to further safeguard our patients?**
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Tips and Pearls

- **Never use paralysis**
- **Always keep the elbow supported**
- **Minimize duration of extremes of motion and retraction**
- **I use 10 mg IV decadron prior to incision to decrease nerve inflammation**
- **Particularly careful in low BMI females <25 BMI**
- **Use cautery to release inferior capsule**
- **Personally prefer to use neuromonitoring**

