Carpal Tunnel Syndrome

Blane Sessions, MD
Louisiana Hand to Shoulder Center
Covington, LA

LOUISIANA HAND TO SHOULDER CENTER

985-238-0045
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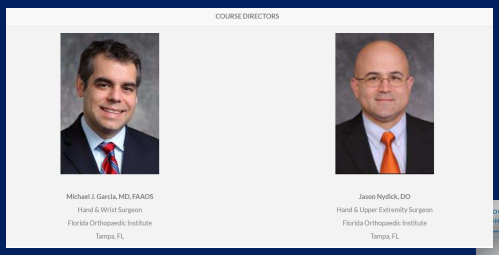
fore FOUNDATION for ORTHOPAEDIC RESEARCH and EDUCATION

Thank you



Disclosure

Paid Consultant:

- AM Surgical - Endo CTR device Stratos®

Also….

Disclosure – But…..

Classic Severe CTS Patient

- 68 y/o RHD male
- 5'11 245lbs
- Numbness and tingling in median nerve distribution for several years with night time symptoms
- Thenar muscle weakness
- Smoker with COPD; HTN; on blood thinners
- Nerve Conduction study reveals Severe Right CTS

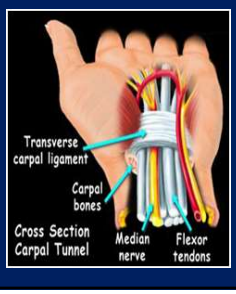
Carpal Tunnel Syndrome

Carpal Tunnel Syndrome

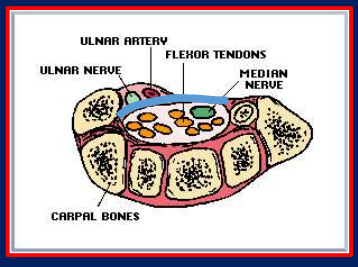
- 1 in 5 people will have CTS symptoms
- Peak Age Groups
  - 50-59
  - 70-79
- Over 500K people have surgery in US alone

Carpal Tunnel Syndrome

- Compression of the Median Nerve at the Wrist
- Nerve gets entrapped



Carpal Tunnel Syndrome



Carpal Tunnel Syndrome

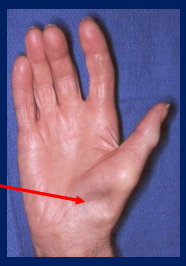
Signs/Symptoms:

- Intermittent Numbness/Tingling
  - Thumb, Index, Middle finger, ½ Ring Finger
- Worse at Night

Carpal Tunnel Syndrome

Signs/Symptoms:

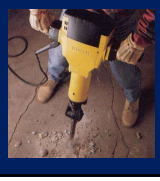
- Pain in Palm/Fingers
  - (longstanding)
- Thumb Muscle Atrophy



Carpal Tunnel Syndrome

Causes:

Typing ?
Heavy Labor
Genetic
Space Occupying Mass
Anatomy
Pregnancy
Arthritis



The Quality and Strength of Evidence for Etiology: Example of Carpal Tunnel Syndrome

Santiago Lozano-Calderón, MD, Shawn Anthony, BS, David Ring, MD, PhD

The Journal of Hand Surgery

JHS • Vol 33A, April 2008

A quantitative score -Bradford Hill criteria

-evaluated 117 articles

- "The etiology of carpal tunnel syndrome is largely structural, genetic, and biological, with environmental and occupational factors such as repetitive hand use playing a minor and more debatable role

Abstract: A Genetic Risk Score for Carpal Tunnel Syndrome

Wiberg, Akira, BA BM BCh MRCS; Ng, Michael, MSc; Schmid, Annina B., PT, MManipTher PhD; Baskozos, Georgios, MSc PhD; Bennett, David L., MB PhD FRCP; Furniss, Dominic, DM MA MBBCh FRCS(Plast)

Plastic and Reconstructive Surgery – Global Open: September 2018 - Volume 6 - Issue 9S - p 63–64
doi: 10.1097/01.GOX.0000546801.74134.68
PSTM 2018 Abstract Supplement

- Genome-wide association study (GWAS) of Carpal Tunnel Syndrome (CTS)
- identified 13 genome-wide susceptibility loci
- obtained genotypic and diagnostic data from UK Biobank (500K)
- developed a weighted genetic risk score (wGRS)
- A higher wGRS correlated with increase in disease severity

Carpal tunnel syndrome and its relation to occupation: a systematic literature review

Keith T. Palmer, E. Clare Harris and David Coggon

2007 study

literature review of occupational risk factors

>2-fold increased risk of CTS with:
- regular prolonged use of handheld vibratory tools
- prolonged highly repetitious flexion and extension of the wrist with forceful gripping

- no association found keyboard or computer work

Computer keyboarding biomechanics and acute changes in median nerve indicative of carpal tunnel syndrome

Kevin K. Toosi [a, b], Nathan S. Hogaboom [b, c], Michelle L. Oyster [b, d], Michael L. Boninger [b, d, e]

[a] Department of Bioengineering, University of Pittsburgh, Pittsburgh, PA, USA
[b] Human Engineering Research Laboratories, VA Pittsburgh Healthcare System, Pittsburgh, PA, USA
[c] Department of Rehabilitation Science and Technology, University of Pittsburgh, Pittsburgh, PA, USA
[d] Department of Physical Medicine and Rehabilitation, University of Pittsburgh, Pittsburgh, PA, USA

Clinical Biomechanics
Volume 30, Issue 6, July 2015, Pages 546-550

37 healthy individuals

Ultrasound images were collected:
- Baseline
- 30 mins of typing
- 60 min of typing
- after 30 min of rest

Findings:

- Median nerve cross-sectional area and swelling ratio increased after 30 and 60 min of typing.
- Responses to typing were greater in those who approached greater peak angles of ulnar deviation.
- Nerve size at 60 min reverted to baseline size after 30 min of rest.

Causes

Occupational Safety and Health Administration (OSHA)

- cumulative trauma disorders
- Occupational risk factors: repetitive tasks, force, posture, and vibration have been cited

OSHA

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Causes

American Society for Surgery of the Hand (ASSH)
- No correlation btw work and CTS

ASSH
American Society for Surgery of the Hand

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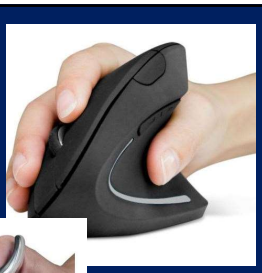
Causes – Public Perception



Somewhere in Between

Nerve Study needed?

Development and Validation of Diagnostic Criteria for Carpal Tunnel Syndrome

Brent Graham, MD, Glenn Regehr, PhD, Gary Naglie, MD, James G. Wright, MD

From the University Health Network, Hospital for Sick Children, Toronto Rehabilitation Institute, Toronto, Ontario, Canada; and the University of Toronto, Toronto, Ontario, Canada.

The Journal of Hand Surgery / Vol. 31A No. 6 July–August 2006

The Journal of Hand Surgery

Table 1. Final List of Unweighted Clinical Diagnostic Criteria

Numbness and tingling in the median nerve distribution
Nocturnal numbness
Weakness and/or atrophy of the thenar musculature
Tinel's sign
Phalen's test
Loss of 2-point discrimination

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Nerve Study needed?

J Bone Joint Surg Am. 2008 Dec;90(12):2587-93. doi: 10.2106/JBJS.G.01362.

The value added by electrodiagnostic testing in the diagnosis of carpal tunnel syndrome.

Graham B[1]

JB&JS

2008 study

143 patients and scored on pretest probability

Conclusion:
History and Physical examination alone

Electrodiagnostic tests:
- do not change the probability of diagnosing this condition to an extent that is clinically relevant

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EMG Needed???

CLINICAL NEUROPHYSIOLOGY

T34. Diagnosing patients with carpal tunnel syndrome: Do you need needle EMG?
Zuniga, Leslie A. et al.
Clinical Neurophysiology , Volume 129 , e14

472 patients diagnosed with CTS given NCV/EMG

Retrospective review

19% of patients seen with CTS had associated cervical radiculopathy picked up by the EMG

"Without needle electromyography, these concurrent diagnoses would be missed, which can affect subsequent management and therapy."

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Ultrasound???

The Use of Diagnostic Ultrasound in Carpal Tunnel Syndrome

Ethan R. Wiesler, MD, George D. Chloros, MD, Michael S. Cartwright, MD, Beth P. Smith, PhD, Julia Rushing, MStat, Francis O. Walker, MD

From the Departments of Orthopaedic Surgery, Neurology, and Public Health Sciences, Wake Forest University School of Medicine, Winston-Salem, NC.

The Journal of Hand Surgery

The Journal of Hand Surgery / Vol. 31A No. 5 May–June 2006

Average cross-sectional area of the median nerve at the distal wrist crease:

- 9 mm2 - asymptomatic volunteers
- 14 mm2 – CTS patients

Insurance Carriers

I do not routinely order nerve studies on patients who have straightforward carpal tunnel syndrome. Over the past few months I have been getting a significant increase in surgery pre-authorization denials because of this. It started out with medicare, but now has spread to United Health Care and BCBS. I had a patient this week who I have been treating conservatively for almost a year with splinting, NSAIDS, and even a steroid injection. Despite this treatment, she now has constant numbness in her index finger along with very painful nocturnal symptoms. BCBS denied her surgery and when I called for a peer to peer review, I was told that they were following Milliman Care Guidelines and that nerve studies were required to confirm the diagnosis regardless of history and physical exam findings. Unfortunately, I have not been able to find these guidelines online. I was wondering if anyone had access to these guidelines or even what studies they were based on.

Humana

- For any CPT 64721/29848:
  - NCS and office records

Treatment Options - Algorithm

- Splints/Braces
- Cortisone Injections
- Surgery

AAOS
American Academy of Orthopaedic Surgeons

CLINICAL PRACTICE GUIDELINE
ON
THE DIAGNOSIS OF
CARPAL TUNNEL SYNDROME

Adopted by the American Academy of Orthopaedic Surgeons

Board of Directors

May 2007

AAOS
American Academy of Orthopaedic Surgeons

MANAGEMENT OF CARPAL TUNNEL SYNDROME
EVIDENCE-BASED CLINICAL PRACTICE GUIDELINE

Adopted by the American Academy of Orthopaedic Surgeons
Board of Directors

February 29, 2016

CTS Impactful Statements

The following impactful statements are based on the Management of Carpal Tunnel Syndrome Clinical Practice Guideline.

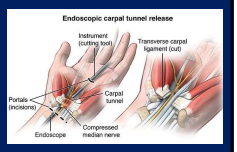
1. Do not use single physical examination tests (Phalen, Tinel) to diagnose CTS, as alone they do not satisfactorily diagnose or rule-out carpal tunnel syndrome.
2. BMI and high hand/wrist repetition rate are associated with the increased risk of developing carpal tunnel syndrome.
3. Magnet therapy is not indicated for the treatment of carpal tunnel syndrome.
4. Surgical treatment of carpal tunnel syndrome should have a greater treatment benefit when compared to splinting, NSAIDs/therapy, and a single steroid injection.

The following recommendation is the basis of the statements above.

1. Strong evidence supports not using the Phalen Test, Tinel Sign, Flick Sign, or Upper limb neurodynamic/nerve tension test (ULNT) criterion A/B as independent physical examination maneuvers to diagnose carpal tunnel syndrome, because alone, each has a poor or weak association with ruling-in or ruling-out carpal tunnel syndrome.
2. Strong evidence supports that BMI and high hand/wrist repetition rate are associated with the increased risk of developing carpal tunnel syndrome (CTS).
3. Strong evidence supports not using magnet therapy for the treatment of carpal tunnel syndrome.
4. Strong evidence supports that surgical treatment of carpal tunnel syndrome should have a greater treatment benefit at 6 and 12 months as compared to splinting, NSAIDs/therapy, and a single steroid injection.

Surgery – How should you do it?

- Open?
- Endoscopic?
- Ultrasound guided?



Doesn't Really Matter – Open vs. Endo

- Trumble TE, Diao E, Abrams RA, Gilbert-Anderson MM. Singleportal endoscopic carpal tunnel release compared with open release: a prospective, randomized trial. J Bone Joint Surg 2002;84A:1107–1115. 22.
- Ferdinand RD, MacLean JGB. Endoscopic versus open carpal tunnel release in bilateral carpal tunnel syndrome. J Bone Joint Surg 2002; 84B:375–379. 23.
- Atroshi I, Larsson GU, Ornstein E, Hofer M, Johnsson R, Ranstam J. Outcomes of endoscopic surgery compared with open surgery for carpal tunnel syndrome among employed patients: randomized controlled trial. BMJ 2006;332:1473. 24. MacDermid JC, Richards RS, Roth JH, Ross DC, King GJW.
- Endoscopic versus open carpal tunnel release: a randomized trial. J Hand Surg 2003;28A:475–480. 25.
- Atroshi I, Hofer M, Larsson G, Ornstein E, Johnsson R, Ranstam J. Open compared with 2-portal endoscopic carpal tunnel release: a 5-year follow-up of a randomized controlled trial. J Hand Surg 2009;34A:266–272.

Doesn't Really Matter – Open vs. Endo

- Abrams R. Endoscopic versus open carpal tunnel release. J Hand Surg 2009;34A:535–539. 27.
- Palmer AK, Toivonen DA. Complications of endoscopic and open carpal tunnel release. J Hand Surg 1999;24A:561–565. 28.
- Schmelzer RE, Della Rocca GJ, Caplin DA. Endoscopic carpal tunnel release: a review of 753 cases in 486 patients. Plast Reconstr Surg 2006;117:177–185. 29.
- Benson LS, Bare AA, Nagle DJ, Harder VS, Williams CS, Visotsky JL. Complications of endoscopic and open carpal tunnel release. Arthroscopy 2006;22:919–924.

Doesn't Really Matter

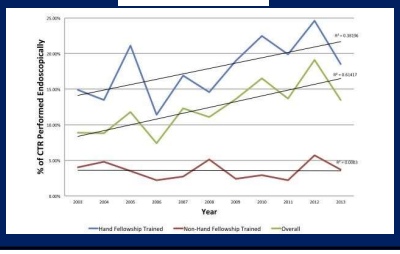
Slight trend ECTR
- less post-op pain
- quicker return to activities

Effects of Hand Fellowship Training on Rates of Endoscopic and Open Carpal Tunnel Release

Brandon S. Smetana, MD,* Xin Zhou, PhD,† Shep Hurwitz, MD,‡ Ganesh V. Kamath, MD,* J. Megan M. Patterson, MD*

The Journal of Hand Surgery
J Hand Surg Am. • Vol. 41, April 2016

2003-2013



Ultrasound guided

CardioVascular and Interventional Radiology
April 2017, Volume 40, Issue 4, pp 568–575 | Cite as

Percutaneous Ultrasound-Guided Carpal Tunnel Release: Study Upon Clinical Efficacy and Safety

Authors | Authors and affiliations
David Petrover, Jonathan Silvera, Thierry De Baere, Marie Vigan, Antoine Hakimé

Open Access | Clinical Investigation
First Online: 27 December 2016
18 Shares 2.3k Downloads 7 Citations

- 129 patients
- MRI
  - showed a complete section of all TCL and nerve decompression in 100% of patients
  - No complications

Treatment Options

Based on Severity of Carpal Tunnel

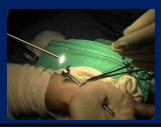
Based On EMG/NCS

test the nerves in the Upper Ext

Severity

- **Mild**
  - Watch
  - Brace
  - Steroid Injection

- **Moderate**
  - Brace
  - Injection
  - Outpatient Surgery to Release Nerve
    - Endoscopic vs. Open Release



Severity

- **Severe**
  - Can Consider Injection
  - Outpatient Surgery to Release Nerve
    - Open Release

Outcomes

Based on Severity

Worse the CTS –
Less Predictable the Results

HOWEVER - Results are Good/Excellent

Infection Rate

Patient-Related Risk Factors for Infection Following Open Carpal Tunnel Release: An Analysis of Over 450,000 Medicare Patients

Brian C. Werner, MD,* Victor A. Terán, BS,* D. Nicole Deal, MD*

Continuing Medical Education

The Journal of Hand Surgery

March 2018 Volume 43, Issue 3, Pages 214–219

2005 – 2012; 7 year period

Postoperative infection within 90 days of surgery

Infection rate of 0.32%

Independent positive risk factors for infection included:

younger age, male sex, obesity (body mass index of 30 to 40), morbid obesity (body mass index greater than 40), tobacco use, alcohol use, and numerous medical comorbidities including diabetes, inflammatory arthritis, peripheral vascular disease, chronic liver disease, chronic kidney disease, chronic lung disease, and depression.

Is main operating room sterility really necessary in carpal tunnel surgery? A multicenter prospective study of minor procedure room field sterility surgery

Martin R. LeBlanc · Donald H. Lalonde · Achilleas Thoma · Mike Bell · Neil Wells · Murray Allen · Peter Chang · Daniel McKee · Jan Lalonde

Published online: 18 November 2010

Field Sterility

1504 Consecutive CTR patients

CONCLUSIONS: A superficial infection rate of 0.4% and a deep infection rate of 0% for incidence of postoperative wound infection using field sterility. This supports the safety CTR using minor procedure field sterility without prophylactic antibiotics. The higher ra are not justified on the basis of infection for CTR cases.

Perioperative Antibiotics for Clean Hand Surgery: A National Study

Shepard P. Johnson, MBBS,* Lin Zhong, MD,† Kevin C. Chung, MD, MS,† Jennifer F. Waljee, MD, MS†

The Journal of Hand Surgery

May 2018 Volume 43, Issue 5, Pages 407–416.e1

Analyzed insurance claims from the Truven MarketScan Databases

5 Procedures – 2009-2015
- open or endoscopic carpal tunnel release
- trigger finger release
- de Quervain release
- wrist ganglion excision

Conclusions:
prophylactic intravenous antibiotics were administered to nearly 1 in 5 patients prior to clean soft tissue hand surgery.

Although consensus guidelines indicate prophylaxis is not indicated, their use has increased steadily in the United States from 2009 to 2015

Does Severity of your CTS Matter?

Severity???

Electrodiagnostic Grade and Carpal Tunnel Release Outcomes: A Prospective Analysis

Michael Rivlin, MD,* Amir R. Kachooei, MD,† Mark L. Wang, MD, PhD,* Asif M. Ilyas, MD*

The Journal of Hand Surgery

J Hand Surg Am. • Vol. 43, May 2018

Electrodiagnostic grades pre and post operatively prior to CTR

Results:
- significant improvement in outcomes regardless of Electrodiagnostic grade

Sleep?

Prospective Evaluation of Sleep Improvement Following Carpal Tunnel Release Surgery

Jacob E. Tulipan, MD,* Nayoung Kim, BS,† Jack Abboudi, MD,‡ Christopher Jones, MD,‡ Frederic Liss, MD,‡ William Kirkpatrick, MD,‡ Jonas Matzon, MD,‡ Michael Rivlin, MD,‡ Mark L. Wang, MD, PhD,‡ Asif M. Ilyas, MD‡

The Journal of Hand Surgery

J Hand Surg Am. • Vol. 42, May 2017

398 patients

-99% available at 2 weeks
-64% available at 3-month final follow-up

Insomnia Severity Index (ISI) scores improved after CTR

"Patients undergoing CTR demonstrated significant improvement in mean scores for 7 aspects of sleep quality."

Sleep improvement
- unrelated to preoperative EMG severity
- within 2 weeks of surgery

-

Costs

A Detailed Cost and Efficiency Analysis of Performing Carpal Tunnel Surgery in the Main Operating Room versus the Ambulatory Setting in Canada

Martin R. Leblanc · Janice Lalonde · Donald H. Lalonde

First Published December 1, 2007 | Research Article

2007 Journal of Hand

3-hours surgical block able to perform:
- 9 CTRs in the ambulatory setting
- 4 CTR in the main OR

Total Cost per Case	Main Operating Room	Ambulatory
Open CTR under local	$137/case	$36/case

Main OR for CTR vs. ambulatory setting:
- Almost four times as expensive
- Less than half as efficient

A Cost, Profit, and Efficiency Analysis of Performing Carpal Tunnel Surgery in the Operating Room Versus the Clinic Setting in the United States

Chatterjee, Abhishek MD, MBA; McCarthy, James E. MD; Montagne, Shirley A. MBA; Leong, Kenneth MD; Kerrigan, Carolyn L. MD

Annals of Plastic Surgery: March 2011 - Volume 66 - Issue 3 - p 245-248
doi: 10.1097/SAP.0b013e3181db7784
Hand Surgery and Microsurgery

Annals of Plastic Surgery

2007

Academic Setting – Dartmouth Hitchcock Medical Center, Lebanon, NH

Total Cost per Case	Operating Room	Clinic
Single port Endo CTR	$2273	$985
Open CTR	$3469	$640

Clinic setting more profitable; net loss for Open CTR in operating room

"Performing either single endoscopic port or open CTR in the operating room is more expensive and less efficient than in the clinic setting."

Cost Implications of Varying the Surgical Technique, Surgical Setting, and Anesthesia Type for Carpal Tunnel Release Surgery

Nikolas H. Kazmers, MD, MSE,* Angela P. Presson, PhD,†† Yithe Xu, MS,††
Abby Howenstein, MD,* Andrew R. Tyser, MD*

The Journal of Hand Surgery

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Consecutive adult patients
-Isolated unilateral CTR between July 2014 - October 2017
University of Utah

Studied:
- Carpal Technique – Open vs. Endo
- Surgical setting – Operating Room vs. Procedure Room
- Anesthetic type - local, MAC, Bier block, general

479 patients

Calculated for each surgical encounter:
- Total direct costs (TDCs)
- Total combined payment (TCP)
- Hospital payment
- Surgeon payment
- Anesthesia payment

Cost Implications of Varying the Surgical Technique, Surgical Setting, and Anesthesia Type for Carpal Tunnel Release Surgery

Nikolas H. Kazmers, MD, MSE,* Angela P. Presson, PhD,†† Yithe Xu, MS,††
Abby Howenstein, MD,* Andrew R. Tyser, MD*

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Findings:

"Performing OCTR under local anesthetic in the procedure room setting significantly minimizes direct surgical encounter costs relative to other surgical methods (ECTR), anesthetic methods (Bier block, MAC, general), and surgical settings (operating room)."

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Endoscopic Versus Open Carpal Tunnel Release: A Detailed Analysis Using Time-Driven Activity-Based Costing at an Academic Medical Center

Daniel M. Koehler, MD,* Ranji Balakrishnan, PhD, MBA,‡ Ericka A. Lawler, MD,*
Apurva S. Shah, MD, MBA‡

The Journal of Hand Surgery

ARTICLE IN PRESS

Time-driven activity-based costing
Economic Analysis

"single academic, tertiary-care hospital in an ambulatory surgery center setting with a mean turnover time between cases of 11.5 minutes"

Total procedural cost:

Endo CTR	Open CTR
$2,759.70	$1,918.06

E CTR was 43.9% greater than the open technique

Cost difference was primarily driven by:
- the disposable endoscopic blade assembly ($217)
- direct operating room costs related to procedural duration (44.8 vs 40.5 minutes)
- physician labor

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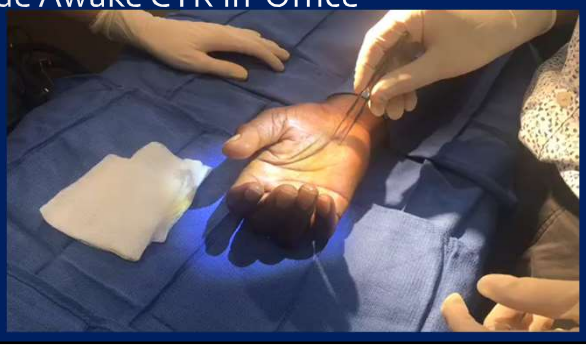
Classic Severe CTS patient

- 20 ml of 1% lidocaine with Epi
- 2 ml of 8.4% Na Bicarb
- 27 gauge needle
- WALANT

Brent Bamberger

Wide Awake CTR In-Office

Wide Awake CTR In-Office



Thank you and Geaux Tigers!!!!