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What are our patients asking Google about acromioclavicular joint injuries?—frequently asked online questions and the quality of online resources



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Background: Management of acromioclavicular (AC) joint injuries has been an ongoing source of debate, with over 150 variations of surgery described in the literature. Without a consensus on surgical technique, patients are seeking answers to common questions through internet resources. This study investigates the most common online patient questions pertaining to AC joint injuries and the quality of the websites providing information.

Hypothesis: 1) Question topics will pertain to surgical indications, pain management, and success of surgery and 2) the quality and transparency of online information are largely heterogeneous.

Methods: Three AC joint search queries were entered into the Google Web Search. Questions under the “People also ask” tab were expanded in order and 100 results for each query were included (300 total). Questions were categorized based on Rothwell’s classification. Websites were categorized by source. Website quality was evaluated by the *Journal of the American Medical Association (JAMA)* Benchmark Criteria.

Results: Most questions fell into the Rothwell Fact category (48.0%). The most common question topics were surgical indications (28.0%), timeline of recovery (13.0%), and diagnosis/evaluation (12.0%). The least common question topics were anatomy/function (3.3%), evaluation of surgery (3.3%), injury comparison (1.0%), and cost (1.0%). The most common websites were medical practice (44.0%), academic (22.3%), and single surgeon personal (12.3%). The average *JAMA* score for all websites was 1.0 ± 1.3 . Government websites had the highest *JAMA* score (4.0 ± 0.0) and constituted 45.8% of all websites with a score of 4/4. PubMed articles constituted 63.6% (7/11) of government website. Comparatively, medical practice websites had the lowest *JAMA* score (0.3 ± 0.7 , range [0–3]).

Conclusion: Online patient AC joint injury questions pertain to surgical indications, timeline of recovery, and diagnosis/evaluation. Government websites and PubMed articles provide the highest-quality sources of reliable, up-to-date information but constitute the smallest proportion of resources. In contrast, medical practice represents the most visited websites, however, recorded the lowest quality score. Physicians should utilize this information to answer frequently asked questions, guide patient expectations, and help provide and identify reliable online resources.

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The acromioclavicular (AC) joint is a diarthrodial joint between the distal clavicle and medial acromion. Static stabilizers of the AC joint consist of the AC capsule and the coracoclavicular ligaments

(trapezoid ligament and conoid ligament). The trapezoid ligament resists horizontal displacement, while the conoid ligament resists vertical displacement. The Rockwood classification (type I–VI) is used to grade AC joint injury based on the amount and direction of clavicle displacement relative to the acromion. Nonoperative management is recommended for type I and II AC joint injuries. Surgical management of type III–VI AC joint injuries has demonstrated advancement over time, with over 150 variations of surgery described in the literature.^{2,3,12,18,20,31} However, no optimal

Institutional review board approval was not required for this literature review.

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procedure exists given the high rate of complications unique to each technique.^{2–4,10,16,30}

Given the multitude of options for AC joint surgery, patients may utilize the internet for orthopedic-related answers. Over 60% of adults utilize the internet for orthopedic-related questions and over 80% use Google as their primary modality for information.^{7,11,27} Online search engines utilize a complex algorithm to compile frequently searched questions and corresponding websites associated with the user's initial search. Users are presented with relevant resources associated with the question, as well as similar questions and corresponding resources. However, despite the abundance of online resources, the quality and transparency of orthopedic-related information are largely heterogeneous.^{8,17,28,29,33}

The influence of patient expectations on clinical outcomes has been well established across surgical subspecialties.^{6,21,24,26,34} Understanding patient concerns and the available online information will allow physicians to guide preoperative and postoperative counseling to help meet these expectations. The objective of this study is to analyze the most common questions patients search online pertaining to AC joint injury and surgery, and the quality of the websites providing information. The authors hypothesize that 1) the majority of question topics will pertain to surgical indications, pain management, and outcomes following surgery and 2) the overall quality and transparency of online information will be heterogeneous.

Materials and methods

Data collection

This study was deemed exempt by the institutional review board of the Columbia University Irving Medical Center. The search terms “acromioclavicular joint injury,” “acromioclavicular joint surgery,” and “acromioclavicular joint reconstruction” were entered into Google Web Search (www.google.com) using the Google Chrome browser (Google, Mountain View, CA, USA). The browser was wiped clean prior to use to avoid the influence of personalized search algorithms in the Google search. A list of frequently asked questions corresponding to each search term was refreshed until approximately 300–500 questions were produced. Scraper (version 1.7; Google Chrome Stores, Mountain View, CA, USA), a data mining web browser extension, was used to extract the questions and webpages to a separate datasheet for analysis.

Exclusion criteria

If the question or corresponding website was unrelated to the topic of the AC joint, then both were excluded from the dataset (eg, rotator cuff, labrum, etc.). Within each query, all repeat questions with the same website link were excluded. In concordance with prior studies, the first 100 questions meeting inclusion criteria were included in the study.^{17,28}

Classifications

The two authors (D.R.G.L. and K.K.O.) separately evaluated each question and website. All discrepancies between the two authors were brought to the third author (M.A.M.) for subsequent determination. First, questions were categorized into one of three main classifications according to Rothwell's classification of questions: fact, policy, or value (Table 1).^{15,17,25,28} Questions were subcategorized into 1 of 16 topics specific to AC joint injury/surgery: anatomy/function, cost, diagnosis/evaluation, injury comparison,

longevity, management, pain, restrictions, risks/complications, specific activities, surgical evaluation, surgical indications, surgical technique, or timeline of recovery (Table 1).

Websites were categorized based on the source: academic, commercial, government, private medical practice, single surgeon personal, or social media (Table II). Academic websites reflected a clear academic mandate (eg, American Academy of Orthopaedic Surgeons, Mayo Clinic, Johns Hopkins Medicine). Commercial websites were maintained by a for-profit entity that was not directly involved in patient care (eg, WebMD, Healthline). Government websites were managed by a national government organization (eg, National Institutes of Health, National Health Service, PubMed). Private medical practice websites were maintained by private medical groups without an academic mandate. Single surgeon personal websites were maintained by a single surgeon and were separate from that individual's affiliation with a larger organization or group medical practice. Social media websites were all websites designed for information dissemination that were maintained by nonmedical organizations (eg, YouTube).

The *Journal of the American Medical Association (JAMA)* Benchmark Criteria was used to evaluate the quality of online information available on each website article. The *JAMA* Benchmark Criteria consists of four categories: authorship, attribution, currency, and disclosure (Table III). A website was assigned 1 point for each criterion met, with the highest possible score being a 4. Articles were evaluated strictly based on what was available on the linked website and not what could be accessed by clicking through additional links. This metric has been used in prior studies to evaluate the quality and transparency of online orthopedic information.^{8,17,19,22,23,28}

Statistical analysis

Pearson's chi-squared tests were used to analyze categorical data. Student's *t*-tests and analysis of variance were performed to compare *JAMA* Benchmark Criteria scores. Bonferroni corrections were used for repeat analyses. All statistical analyses were performed using STATA/MP Software 13.0 (StataCorp LLC, College Station, TX, USA). Statistical significance was set at $P < .05$.

Results

A total of 100 unique questions and websites for each query were included in the current study. Most questions fell into the Rothwell classification category Fact (41.8% of questions) (Tables IV and V). The most common question topics were surgical indications (28.0%), timeline of recovery (13.0%), diagnosis/evaluation (12.0%), and pain (11.3%) (Table V). The least common topics were anatomy/function (3.3%), evaluation of surgery (3.3%), injury comparison (1.0%), and cost (1.0%) (Table V).

The distribution of website types was as follows: medical practice (44.0%), academic (22.3%), single surgeon personal (12.3%), commercial (10.3%), social media (7.3%), and government (3.7%) (Table VI). PubMed articles constituted 63.6% of government websites and 2.3% of overall websites.

The average *JAMA* Benchmark Criteria score for all websites was 1.0 ± 1.3 . Website categories with the highest *JAMA* scores were government (4.0 ± 0.0) and commercial (2.6 ± 1.0) (Table VII). PubMed articles constituted 81.8% of government websites. Government websites constituted 45.8% of websites with a score of 4/4. The full distribution of *JAMA* scores can be found in Table VIII.

Academic websites were associated with pain (22.4%) and timeline of recovery (19.4%). Commercial websites were associated with evaluation of surgery (22.6%), surgical indications (12.9%), and risks/complications (12.9%). Government websites

Table I
Rothwell’s classification system categorization of questions on acromioclavicular joint injury and surgery with subcategories, definitions, and examples.

Rothwell classification	Description	Example
Fact	Asks whether something is true and to what extent, objective information	What is AC joint surgery?
Policy	Asks whether a specific course of action should be taken to solve a problem (open-ended)	Is there an alternative to AC joint surgery?
Value	Asks for evaluation of an idea, object, or event	How severe is the pain in an AC joint injury?
Question classification by topic	Description	Example
Fact		
Specific activities	Ability to perform a specific activity or action after surgery/injury	Will I be able to walk after AC joint surgery?
Restrictions	Restrictions to activity or lifestyle during recovery or indefinitely	Is it safe to walk with an AC joint injury?
Timeline of recovery	Specific questions regarding length of time for recovery milestones	When can I run after AC joint surgery?
Technical details	Details of surgical procedure	Is AC joint surgery arthroscopic?
Cost	Cost of surgery and/or rehabilitation postoperatively	How much does AC joint surgery cost?
Anatomy/Function	Specific questions regarding the structure and function of the AC joint	What does the AC joint do?
Diagnosis/Evaluation	Questions regarding how one knows they have an AC joint injury	How do I know I have an AC joint tear?
Management	Benefit of specific intervention for injury	Is bracing good for AC joint injury?
Policy		
Surgical indications	Surgical indications and timing of surgery	When do you need surgery for an AC joint tear?
Risks/Complications	Management of risks/complications during and after surgery	What are the risks of AC joint surgery?
Value		
Pain	Pertains to duration, severity, and management of pain	How much does an AC joint tear hurt?
Longevity	Specific questions regarding longevity of AC joint treatment/surgery	How long will an AC joint repair last?
Evaluation of surgery	Evaluation of the successfulness or invasiveness of AC joint surgery?	How safe is AC joint surgery?
Injury comparison	Comparison between AC joint injury and other injuries regarding severity, recovery, etc.	Is an AC joint injury worse than a rotator cuff tear?

Table II
Categorization of websites with definitions and examples of each type.

Website categorization	Definition	Examples (based on prior literature)
Academic	Institution with clear academic mandate, including universities, academic medical centers, academic societies	American Academy of Orthopaedic Surgeons, Mayo Clinic
Commercial	Commercial organization that positions itself as a source of health information, includes medical device and pharmaceutical companies	WebMD, Healthline, DonJoy Performance
Government	Websites ending in.gov or maintained by a national government	Medline, PubMed
Medical practice	Local hospital or orthopedic practice without an academic affiliation	New York Orthopedics
Single surgeon personal	Website built and maintained by individual surgeon. Excludes biography pages on institutional websites	EdwinSu.com, DrRMarx.com
Social media	Websites maintained by nonmedical organization primarily designed for information sharing between internet users. Includes health blogs, internet forums, and support groups	YouTube

Table III
Journal of the American Medical Association (JAMA) benchmark criteria.

JAMA Benchmark Criteria	Definition
Authorship	Clearly identifiable author and contributors with affiliations and relevant credentials present
Attribution	References and sources clearly listed with any copyright information disclosed
Currency	Clearly identifiable posting date of any content as well as the date of any revisions
Disclosure	Website ownership is clearly disclosed along with any sponsorship, advertising, underwriting, and financial support

Table IV
Distribution of Rothwell classification categories within each search query and total percentage of each category.

Search query	Rothwell classification		
	Fact	Policy	Value
AC joint injury	27	14	26
AC joint surgery	9	10	12
AC joint reconstruction	55	20	25
Total (N)	176	67	66
Overall %	58.7%	22.3%	22.0%

were associated with diagnosis/evaluation (18.2%), pain (18.2%), and specific activities (18.2%). Medical practice websites were associated with surgical indications (20.5%), diagnosis/evaluation (12.1%), and timeline of recovery (11.4%). Single surgeon personal websites were associated with surgical indications (18.9%),

timeline of recovery (16.2%), pain (13.5%), and specific activities (13.5%). Social media websites were associated with specific activities (31.8%) surgical indications (27.3%), and restrictions (18.2%). The full distribution of question topics within each website category can be found in [Table IX](#).

Discussion

This study demonstrates that patients are primarily concerned with surgical indications for AC joint injuries (28.0% of all question topics). Given that there is no definitive consensus on treatment for AC joint injuries, patients may feel inundated with information regarding the correct treatment algorithms. Currently, there is consensus that Rockwood type I and II injuries warrant nonsurgical management and type IV–VI injuries warrant surgery. However, treatment for type III injuries remains more

Table V
Distribution of Rothwell classification subcategories based on each search query.

Search query	Rothwell classification of questions													
	Fact					Policy					Value			
	Specific activities	Restrictions	Timeline of recovery	Technical details	Cost	Anatomy/Function	Diagnosis/Evaluation	Management	Surgical indications	Risks/Complications	Pain	Longevity	Evaluation of surgery	Injury comparison
AC joint injury	6	2	12	1	0	6	24	11	21	1	12	3	1	0
AC joint surgery	9	10	10	8	2	2	7	2	17	7	13	9	2	2
AC joint reconstruction	12	8	17	4	1	2	5	6	16	5	9	7	7	1
Total (N)	27	20	39	13	3	10	36	19	54	13	34	19	10	3
Overall %	9.0	6.7	13.0	4.3	1.0	3.3	12.0	6.3	18.0	4.3	11.3	6.3	3.3	1.0

Table VI
Distribution of website category.

Website category	N	%
Medical practice	132	44.0
Academic	67	22.3
Single surgeon personal	37	12.3
Commercial	31	10.3
Social media	22	7.3
Government	11	3.7
Total	300	100

Table VII
Average JAMA Benchmark Criteria score for each website category.

Website category	Score ± standard deviation
Government	4.0±0.0
Commercial	2.6±1.0
Academic	1.3±1.7
Social media	1.1±0.6
Single surgeon personal	0.5±0.6
Medical practice	0.4±0.7

Table VIII
Distribution of websites as a percentage for each JAMA Benchmark Criteria score (0–4).

Website type	JAMA Benchmark Criteria				
	0	1	2	3	4
Academic	58.2	3.0	3.0	20.9	14.9
Commercial	3.2	16.1	12.9	58.1	9.7
Government	0.0	0.0	0.0	0.0	100.0
Medical practice	65.9	26.5	6.8	0.8	0.0
Single surgeon personal	67.6	24.3	8.1	0.0	0.0
Social media	9.1	77.3	9.1	4.5	0.0
Total	100	100	100	100	100

controversial. Even for type IV–VI injuries, surgeons may recommend different surgical techniques (eg, Bosworth screw fixation, AC hook plate fixation, Weaver-Dunn procedure, modified Weaver-Dunn procedure, coracoclavicular ligament reconstruction) as there is no consensus on which method provides superior outcomes.^{2–4,10,16,30} Many of the Google searches categorized under surgical indications pertained to the grade of the AC joint injury and whether surgery is required (eg, “Which grades of AC joint injury require surgery?” “Does a grade 3 AC joint injury require surgery?”). These questions reflect that patients are understanding their injury characteristics and are curious whether surgery is warranted, particularly for type III injuries. Thus, physicians should clearly discuss the surgical indications based on the patient’s injury characteristics.

Diagnosis/Evaluation was the third most common question topic (12.0%). Proper diagnosis and classification of AC joint injuries are important to guide subsequent management. Many of the diagnosis/evaluation questions suggest patients are attempting to self-diagnose injuries prior to meeting with a physician (eg, “What are signs and symptoms of an AC joint injury?” “What grade is my AC joint injury?” “How is an AC joint injury diagnosed?”). Although various physical exam maneuvers may be positive in an AC joint injury (eg, tenderness to palpation, instability, pain with O’Brien’s test, pain with cross-body adduction), radiographs allow physicians to evaluate the degree and direction of displacement.^{10,20,30} Without seeing a healthcare provider and attaining proper imaging, patients are at risk when self-diagnosing or self-managing AC joint injuries.

Table IX
Distribution of Rothwell classification subcategories based on website type.

Website	Rothwell classification of questions										Total %	
	Fact					Policy						Value
	Specific activities	Restrictions	Timeline of recovery	Technical details	Cost Anatomy/Function	Diagnosis/Evaluation	Management	Surgical indications	Risks/Complications	Pain Longevity	Evaluation of surgery	Injury comparison
Academic	3.0	4.5	19.4	3.0	3.0	13.4	1.5	17.9	3.0	22.4	1.5	8.9
Commercial	0.0	6.5	9.7	3.2	0.0	9.7	12.9	6.5	12.9	3.2	6.5	17.5
Government	18.2	9.1	0.0	0.0	9.1	18.2	9.1	0.0	0.0	18.2	9.1	2.9
Medical practice	8.3	6.1	11.4	6.1	0.0	12.1	9.1	20.5	3.8	8.3	5.3	18.9
Single surgeon personal	13.5	5.4	16.2	5.4	0.0	8.1	2.7	18.9	5.4	13.5	10.8	0.0
Social media	31.8	18.2	9.1	0.0	0.0	13.6	0.0	27.3	0.0	0.0	0.0	0.0

Inaccurate self-diagnoses and attempts to manage type IV-VI AC joint injuries nonoperatively can lead to worse outcomes. However, self-treatment is not unexpected, as the majority of conditions are treated outside of formal healthcare systems.¹³ Furthermore, questions regarding the grade of AC joint injury reflect patient knowledge about how this dictates the treatment course.

The overall average JAMA Benchmark Criteria score of websites in this study was 1.0 ± 1.3 , indicating low quality and transparency of information. Approximately 81% of websites had a JAMA score of ≤ 2 and 92% had a score of ≤ 3 . Government websites had the highest score (4.0 ± 0.0), with PubMed constituting 81% of these websites. This can be attributed to the stringent submission and publishing standards requiring date of publication, degrees of authors, scientific references, and financial disclosures. However, government websites constituted the fewest websites (3.7%) providing information. Similarly, prior studies found that government websites had the highest JAMA score ranging from 3.4 to 3.9, but constituted only 4.5%-6.6% of all websites.^{22,28} Commercial websites had the second highest JAMA score (2.6 ± 1.0) in this study, which is consistent with prior reports.^{22,28} This can be attributed to many reputable websites, such as Healthline and WebMD, constituting a large proportion of commercial websites in this study. These websites hire physicians to provide orthopedic information using up-to-date references, corresponding to a higher JAMA score. However, prior studies suggest that commercial websites publish misinformation at a 5 times greater rate, which may be driven by the incentive to promote a product or treatment.³² Patients should exercise caution when navigating online websites to avoid going down “rabbit holes” of misinformation. Excessive internet searching for online orthopedic information, or cyberchondria, can create increased anxiety about one’s health.⁵ Thus, physicians should guide patients toward reputable online resources to avoid the dissemination of misinformation.

Longevity and risks/complications questions constituted only 6.3% and 4.3% of questions, respectively. This was unexpected given the high rates of complications and variable outcomes associated with different AC joint procedures.^{3,10,12,20,30} However, prior studies demonstrate longevity and risks/complications constitute 0.5%-1.2% and 3.0%-5.6% of overall questions asked, respectively.^{17,22,28} One explanation is that websites are tailoring content to help patients understand their diagnosis and the surgical indications without adequately addressing the complications or long-term success. This is evidenced by surgical indications constituting the largest proportion of topics for medical practice and single surgeon personal websites in the current study. Furthermore, medical practice and single surgeon websites were two of the top three most common websites (44.0% and 12.3%, respectively). These websites are omitting references and/or publication dates, reflected in the low JAMA scores, facilitating the dissemination of misleading or out-of-date information. Thus, patients may have fewer questions and knowledge regarding complications and longevity of AC joint surgery due to lack of online transparency among most online websites.

Unlike commercial, academic, or government websites, physicians have the greatest control to the influence the information published on medical practice and single surgeon personal websites. Given the various resources available on the internet, it is important that physicians ensure online information is presented at a 6th-8th grade level to accommodate patients with low health and educational literacy.^{1,14} Critically evaluating the information published and ensuring universal understanding regarding the treatment options can improve patient satisfaction postoperatively.⁹

There are limitations inherent to the methodology. First, the JAMA Benchmark Criteria were established as a simplified approach to evaluate the quality of online information. Importantly, it acts as a proxy of transparency and is not indicative of content accuracy as articles can have a perfect score if they contain the author's name and relevant degree(s), the date of publication, references, and any financial disclosures. This approach assumes that the content is accurate based on the incorporation of references. Second, the original purpose of the Rothwell's classification was to evaluate questions asked in small groups, not online health information. However, prior studies have deemed it appropriate for online orthopedic-related questions.^{17,22,28} Third, although the authors reference patients as the cohort researching online health information, this can be generalized to many other individuals (eg, friends, families, healthcare providers). Based on the Google search algorithm, it is impossible to determine who conducted the searches and whether variation exists between different cohorts of individuals (ie, patients vs. family members vs. healthcare providers). However, the anonymity of online searches reduces the influence of biases associated with in-person surveys. Lastly, it is impossible to tell at what point in the treatment course these individuals searched the questions online (ie, prior to meeting with the surgeon, undergoing nonoperative management, preparing for surgery, or recovering postoperatively).

Conclusion

Online patient AC joint injury questions pertain to surgical indications, timeline of recovery, and diagnosis/evaluation. This is particularly relevant given that operative treatment of AC joint injuries has not been fully optimized, with a variety of described surgical techniques and no clear superior option. Government websites and PubMed articles provide the highest-quality sources of reliable, up-to-date information but constitute the smallest proportion of resources. Medical practice, academic, and single surgeon personal websites represent the largest portion of websites visited but recorded the lowest quality scores. Physicians can use this information to guide patient expectations and help them identify reliable online resources.

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