Original Investigation

Uterine Artery Embolization: An Analysis of Online Patient Information Quality and Readability with Historical Comparison

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Rationale and Objectives: Investigators aimed to assess online information describing uterine artery embolization (UAE) to examine the quality and readability of websites patients are accessing.

Materials and Methods: A list of applicable, commonly used searchable terms was generated, including "Uterine Artery Embolization," "Fibroid Embolization," "Uterine Fibroid Embolization," and "Uterine Artery Embolisation." Each possible term was assessed across the five most-used English language search engines to determine the most commonly used term. The most common term was then investigated across each search engine, with the first 25 pages returned by each engine included for analysis. Duplicate pages, nontext content such as video or audio, and pages behind paywalls were excluded. Pages were analyzed for quality and readability using validated tools including DISCERN score, JAMA Benchmark Criteria, HONcode Certification, Flesch Reading Ease Score, Flesch-Kincaid Grade Level, and Gunning-Fog Index. Secondary features such as age, rank, author, and publisher were recorded.

Results: The most common applicable term was "Uterine Artery Embolization" (492,900 results). Mean DISCERN quality of information provided by UAE websites is "fair"; however, it has declined since comparative 2012 studies. Adherence to JAMA Benchmark Criteria has reduced to 6.7%. UAE website readability remains more difficult than the World Health Organization–recommended 7–8th grade reading levels. HONcode-certified websites (35.6%) demonstrated significantly higher quality than noncertified websites.

Conclusions: Quality of online UAE information remains "fair." Adherence to JAMA benchmark criteria is poor. Readability is above recommended 7–8th grade levels. HONcode certification was predictive of higher website quality, a useful guide to patients requesting additional information.

Key Words: Uterine; embolization; fibroid; patient; information; online; Internet.

INTRODUCTION

Uterine artery embolization (UAE) is a widely performed radiological intervention, most commonly for the treatment of symptomatic uterine fibroids. Although patients decide on treatments in consultation with healthcare providers, the majority of patients also use the Internet for healthcare-related information (1). This information is beyond the control of healthcare providers, and a more in-depth understanding of this information may help healthcare providers make helpful recommendations to patients or alert healthcare providers to low-quality information which may influence patients.

In 2012, studies by Tavare et al. and by Kaicker et al. separately assessed the readability and quality of Internet information regarding UAE (2,3) (of note the study by Kaicker et al study was performed and e-published in 2012, however written publication occurred in 2013). Although the definition of quality may vary, standardized validated tools (such as the DISCERN instrument) have been developed to quantify the quality of healthcare information. The quality of healthcare information on the World Wide Web is variable. Kaicker et al. found the quality of UAE websites to be "fair." Furthermore, only 26% of websites met the *Journal of American Medical Association* (JAMA) benchmarks for quality online information. Guidelines suggest that healthcare information for the general public should be written at a seventh to eighth grade (US) reading level (4). In 2012, Tavare et al. demonstrated that website information on UAE was written at a college grade reading level (Flesch Reading Ease Score [FRES] of 42) (2).

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The studies of Kaicker et al. and Tavare et al. concluded that there were deficiencies in website quality and readability, and called for an increase in high-quality patient-focused information (2,3).

Between 2012 and 2017, the number of all websites increased by 72% (from 697 million to 1.2 billion) (5). During the same period, the number of Internet users also increased by 61% (from 2.3 billion to 3.7 billion people) (6). Annual global information transfer has increased by 190% (from 2.6 to 7.7 zettabytes) (7). The effect of this rapid expansion in information volume on online patient information quality and readability has not been addressed in the literature to date. Search engines are the patient's gateway to healthcare information. Only 13% of patients seek a specific healthcare website when investigating a given topic; Internet search engines remain the most common starting point for patients seeking information (1). The purpose of this study is to assess the online information available in relation to UAE by measuring its quality and readability, and to compare it to the 2012 studies to assess for change.

MATERIALS AND METHODS

A list of the four most familiar search terms describing the embolization of uterine fibroids (leiomyoma) was selected by authors familiar with the procedure (TEM, DO'N) from both the relevant literature and the patient-information websites: *Uterine Artery Embolization, Fibroid Embolization*, *Uterine Fibroid Embolization* and *Uterine Artery Embolisation*. The word-order for each term or phrase was only searched in a grammatically correct and common-usage sequence, for example, "*Uterine Fibroid Embolization*" was considered correct and likely to be searched, whereas "*Uterine Embolization Fibroid*" or "*Embolization Fibroid Uterine*" does not typically appear in that word-order in the literature or patient information, and thus is unlikely to be representative of patients' online searches. Each of the four commonly used terms or phrase was searched across all five chosen search engines to determine which yielded the most results, and this term was selected for analysis. The selected search term was interrogated on the five most popular English-language search engines (Google, Bing!, Yahoo, ask.com, and AOL Search) (8). Search terms were used without Boolean operators [such as AND or OR], quotations, or modifiers, as these are rarely used by patients during health-related Internet searches (9). As it is known that patients are unlikely to view beyond 25 pages, the top-ranked 25 pages for each search engine were recorded consistent with previous studies (9,10). No websites outside of the top 25 search-engine results were analyzed. Where there was pagination of the linked article, with the resulting article spread across several sequential pages, the entirety of that article was analyzed.

The inclusion criterion was the top 25 search results for the selected search term on each of the five selected search engines. Exclusion criteria prohibited duplicate pages or websites that were a subsection of another previously analyzed website, websites requiring payment to access the full page content, paid advertisements on the search-engines' results page, nontext websites (displaying video or audio such as YouTube), or nontext pages that simply redirected users. All search engine analysis was performed within the month of May 2017.

Quality

Each page was assessed for quality using three validated methods; the JAMA Benchmark Criteria; the DISCERN instrument, and Health on the Net Foundation (HONcode) certification (10). The JAMA Benchmark Criteria were proposed by the *Journal of the American Medical Association* as criteria which all online information should fulfill, describing authorship of content, sources, date of update, and disclosures (ownership, sponsorship, advertisement policy, and conflicts of interest) (11). A binary scoring (presence or absence) for each of the four categories was recorded. Website publishing organization was recorded either from the webpage itself if specified or if not was obtained from the *About Us/Contact Us* tab of the website. The age of the website (either the date of creation or last reported update, whichever was most recent) was recorded to assess for up-to-dateness.

The DISCERN instrument was developed in collaboration between the National Health Service (NHS), the British Library, and UK universities, and assesses the quality of an information source by scoring 16 items assessing important aspects of information reliability, description of treatment choices, and overall information quality (12). Each of the 16 items is given a score of 1 (worst) to 5 (best), indicating how well a piece of healthcare information performed in each particular category. A higher score indicates higher quality healthcare information. Scoring was recorded by author TEM, with consensus scoring with TEM in cases of uncertainty.

HONcode certification is a not-for-profit nongovernmental organization affiliated with the World Health Organization (WHO), which certifies websites that provide quality, objective, and transparent medical information tailored to the needs of patients (13). Each website was checked against the Health on the Net (HONcode) online database, and either the presence or absence of HONcode certification was recorded. Where websites indicated a date of content creation or update, the most recent date was recorded. The content producer was categorized in accordance with the following groups: healthcare provider, medical journal, professional society, for-profit corporation, and not-for-profit organization (including governmental and nongovernmental organizations). The qualifications of the author were recorded under the following categories: doctor, nurse, nonmedical author, medical staff not otherwise specified, or not reported.

Readability

Each page was assessed for readability using a variety of assessment tools via an online analysis tool: the Flesch Reading Ease Score (FRES), the Flesch-Kincaid Grade Level (FKGL), and the Gunning-Fog Index (GFI) (14). The FKGL score was