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ORIGINAL PAPER

The Use of the Internet in Data Assimilation in Rare Diseases

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Abstract The incidence and prevalence of achalasia is 0.6/100,000 people per year and 1/10,000, respectively. It is difficult then for one center to accumulate a large cohort of patients. One study (*Gut* 33:1011,1992) described the presenting symptoms in only 38 patients. To approach this problem differently, we used the internet to access a larger patient population. Using search engines at Google^{TM} and Yahoo^{TM}, Inc., we identified achalasia support groups. We examined the most populated support group (YSG) and assembled the exchanged messages into 4 categories: support, symptoms, treatment, and diagnosis. Next, a survey modeled after a previous study (ibid) was composed and posted on a university-sponsored Web site for March 2003, advertised to YSG members, and then removed from the server. The results were entered into a database and analyzed. There were 6 support groups identified; 1 was foreign. The most populated site was the Yahoo^{TM}, Inc., group with 298 active members. We analyzed the 3,222 messages posted from October 6, 2002 through October 5, 2003. The message composition was as follows: 67% support, 16% symptoms, 12% treatment, and 5% diagnosis. Of 298 Yahoo^{TM} site members, we had 88 respondents to the survey from 9 countries. The data from 83 were analyzed (5 were not completed). Respondents were 66 women (55%), 29 men (24%), and 5 non–gender-identified respondents. They ranged in age from 6 to 72 years at time of diagnosis. In the 83 respondents, dysphagia symptoms were reported by 98%, regurgitation by 68%, chest pain by 81%, weight loss by 69%, and epigastric pain by 67%, similar to those reported in the study cited in *Gut*. The modalities used to evaluate these achalasia patients were as follows: 83% had monometry, 87% had radiography, and 89% had endoscopy. The mean time from symptom onset to diagnosis was 5 years. The treatments attempted on this population were balloon dilatation in 57%, botulinum toxin injection (Botox) in 8%, myotomy in 12%, by lifestyle/diet modification in 12%, and other treatments in 11%. We believe that the Internet can provide physician–researchers with useful information about common and uncommon diseases on a global basis. The Internet allows patients to voice concerns that they may not freely express to their doctor and provides a modality to collect data from a larger number of patients than may be available at any single institution.

Keywords Internet · Achalasia · Esophagus · Dysphagia · Dysmotility · Surveys

Introduction

The incidence of achalasia is estimated to be only 0.6 cases per 100,000 people per year with a prevalence of approximately 10 cases per 100,000 people; consequently, it has been difficult for investigators to study large cohorts of patients [1, 2]. A 5-year prospective study published in *Gut* in 1992 described the presenting symptoms of achalasia in a total of 38 patients [3]. During a 6-year period from 1982–1988, Meshkinpour *et al.* [4] evaluated the symptoms of 138 patients with clinical suspicion of achalasia referred for an esophageal motility study. Because of the low incidence of achalasia, either more than 1 site is required to accumulate

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patients or a longer time interval is needed. In addition, single-site studies are open to investigator bias and may not accurately reflect what occurs in the community.

To investigate the presenting symptoms of achalasia and modes of treatment in a diverse population, we sought to develop an alternative method to gather information. By utilizing the Internet as a medical investigative tool for uncommon diseases, we set out to find the presenting symptoms of achalasia in a cross-section of sufferers within achalasia Internet support groups. Our goal was to evaluate the presenting symptoms on a global scale in an efficient and timely manner and to assess the utility of employing Internet patient support groups to garner information.

Literature review and methods

We searched the medical literature for papers describing achalasia symptoms from 1970 to the present using MEDLINE™, PIER™ (Physicians' Information and Education Resource), and MD CONSULT™. The search strategy included using the terms *achalasia symptoms* and *symptoms of achalasia*. Science Citation Index was used to determine the number of times an article had been cited.

Using the search term *achalasia support groups*, we used the Google™, Yahoo™, and MSN™ search engines to identify achalasia support groups. This method excluded Web sites that did not provide opportunities for respondents to interact, such as information sites. We studied the most populated Achalasia Support Group (ASG). The support group manager was contacted for permission to contact its registered members. After we met their guidelines, we requested approval through our institution's Human Assurance Committee (HAC) to start gathering data.

We notified the support group Web site manager and its members that we would like to monitor their strings of conversation from October 2001 to October 2002 and were granted permission from the Web site manager. We notified all site members that their prior strings of conversation were being reviewed by a group of achalasia investigators. We analyzed the strings of conversation from October 6, 2001 to October 5, 2002. Analysis of the first 500 strings of conversation (15% of the total messages exchanged) allowed us to assign notes to one of the following 4 categories: support, symptoms, treatment, or diagnosis. Because we were examining a support group, we anticipated that the majority of messages would be statements of support for one another.

Next, we developed a survey modeled after the 1997 German achalasia study of symptoms, performed by Eckardt *et al.* [5]. In our survey, we also included such questions as demographics, ethnicity, family history, age when symptoms first presented, age when diagnosis was confirmed, and diagnostic modalities. Next, we identified the most commonly used treatment modalities cited in the scientific literature. Respondents were asked what treatment they received initially, in what order they received these most common treatments, and their relative success with that treatment. Last, we asked respondents to rate their overall satisfaction with their treatments by using the following satisfaction scale options: none, some, or great. This survey format was reviewed and approved by the HAC and posted to the institution's Web server.

An e-mail was then sent to all 298 current members of the most populated ASG asking them to complete the achalasia survey. The survey was posted for 1 month, March 2003, and then removed from the Web server. Finally, the responses were converted to a database for further study and compared to the previously published data.

Results

Using Science Citation Index, the most frequently cited article (cited 50 times) on presenting symptoms in achalasia patients was written by Howard *et al.* in *Gut* in 1992 [3] describing the presenting symptoms of achalasia based on a 5-year study of the presenting 38 untreated patients from Scotland. Eckardt *et al.* in 1997 [5] published data on 87 consecutive patients, followed 15 years, assessing the duration and severity of symptoms in newly diagnosed patients with achalasia. We also examined articles cited in PIER™ and MD Consult™ and in textbooks for similar information. This information formed the basis of our questionnaire.

The search engines identified six internet based ASGs. Five of the 6 were based in the United States and 4 of the 6 were also private. One of the 4 private support groups was a medical university-based support group Web site, www.neuro-mancer.mgh.harvard.edu, sponsored by Massachusetts General Hospital, which included 17 registered members. We found the most populated public on-line ASG was the Yahoo, Inc., Support Group (YSG), www.groups.yahoo.com/group/achalasia, which contained 298 unique registered members.

A total of 5,167 messages were exchanged and posted between May 29, 1999 and October 6, 2002 at YSG. We examined the year of messages exchanged between October 6, 2001 and October 5, 2002. During this period, there were a total of 3,222 unique messages posted on the support group Web site.

The majority (67%) of on-line messages were, as expected, of a supportive nature, discussing what patients may experience after surgery or providing advice to fellow members. These support messages came from a large number of individuals, not just 1 person. Messages pertaining to the symptoms of achalasia (16%) were the second most frequent category. Examples of symptom threads included foods getting stuck, weight loss, abdominal pain, regurgitation, and chest pain. The third group, treatment messages (12%),

Table 1 Demographics of American respondents

	Females	Males
Ethnicity (%)		
White, non-Hispanic	61.3	29.1
Black, non-Hispanic	1.6	3.2
Gender only identified (%)	0	1.6
No gender/ethnicity identified	3.2	

included treatment modalities for achalasia, such as questions about balloon dilation, dangers of botulinum toxin, where to go for treatment, and alternative surgical procedures. The last group, diagnosis questions (6% of messages), included the role of endoscopy, appropriate diagnostic tools, the use of barium swallow, and diagnostic errors.

During the 1 month that the survey was posted, 88 survey responses were submitted. Three surveys were discarded because they were duplicate entries, and 2 respondents opened but did not complete the survey. The data from the remaining 83 respondents were analyzed.

Demographics of the respondents were as follows: 55/83 (66%) were female, 24/83 (29%) were male, and 4/83 (5%) did not identify their gender. Of the 83 respondents, 62 (75%) identified themselves as being from the United States. These demographics are summarized in Table 1.

The 25% ($n=21$) of the respondents who were from outside the United States originated from Canada ($n=9$), the United Kingdom ($n=4$), Australia ($n=3$), Columbia ($n=1$), Germany ($n=1$), Israel ($n=1$), New Zealand ($n=1$), and the Philippines ($n=1$). Six (14%) identified a relative as having been diagnosed with achalasia. One (1/83) identified achalasia in their mother, 1 (1/83) in a brother, 2 (2/83) in a grandmother, and 2 (2/83) in a distant relative.

We asked the respondents when their symptoms first started and when the diagnosis was established, based on their age. The median age for the onset of symptoms was 36 years and there was no statistical difference between males (38 years of age) and females (34 years of age). The median time from initial symptoms to establishing the diagnosis was 2 years. Again, no statistically significant difference was seen between males (1.5 years) and females (2 years). Our study found that the mean time from symptom presentation to confirmation of the diagnosis of achalasia was 4.3 years in females and 4.8 years in males. When averaging both genders, we established a mean time to diagnosis of 4.4 years.

We also examined the presenting symptoms of achalasia in a cross-section of all members in the YSG internet support group. Patients were asked about their achalasia symptoms at presentation prior to treatment. Their responses were 98% (81/83) complained of difficulty swallowing, 81% (66/83) chest pain, 68% regurgitation (vomiting) of undigested food, 69% (57/83) weight loss, and 68% (56/83) epigastric pain (heartburn). These results are compared to Eckardt *et al.* [5] and Howard *et al.* [3] in Table 2. All articles reported symptoms of dysphagia, chest pain, and weight loss.

Table 2 Comparison of the incidence of reported symptoms of achalasia

	Studies on Achalasia Symptoms		
Symptoms	Internet 2003	Eckardt *et al.* [5]	Howard *et al.* [3]
Dysphagia (%)	98	98	98
Chest pain (%)	81	77	74
Weight loss (%)	69	65	60
Epigastric pain (%)	68	20	
Regurgitation (%)	68	85	

Diagnosis was established in the 83 respondents as follows: 74 received endoscopic evaluation, 72 received radiographic studies, and 69 received manometry. These data indicate that in most patients more than one modality was employed in their evaluation leading to the diagnosis of achalasia.

We investigated the patient's perspective of the overall success rate for the current treatment options by using a simple degree of satisfaction scale: great, some, or none. The respondents were asked in what order they received the most common treatments and their relative success with their treatments.

Sixty percent of respondents (50/83) reported balloon dilation as their primary treatment modality. Of this group, 27 (54%) rated their treatment satisfaction as some or great. Four of the 50 respondents (8%) undergoing balloon dilation did not rate their treatment satisfaction, and the remaining 19 respondents (38%) reported no improvement.

Of the 50 respondents who underwent balloon dilation as their first treatment modality, 34 (68%) underwent balloon dilation a second time. Five (10%) underwent Botox as a secondary treatment modality. Seven (14%) reported surgical myotomy as their second treatment modality. One (2%) reported life style modifications and 3 (6%) reported other treatments such as medication.

Nine out of 10 of those who underwent myotomy as their primary treatment modality rated their satisfaction as some or great. The number who underwent myotomy was small, preventing group comparison. Interestingly, 8 of the 10 undergoing myotomy reported balloon dilation as a needed second treatment modality. Six out of 10 respondents receiving life style and diet modification as their primary treatment rated their relief as some or great. Botox injection and "other" treatment modalities had fewer than 10 respondents for each category, limiting comparison data.

Many patients reported the need for more than 1 treatment, presumably due to lack of response of the first treatment. Forty-one percent (34/83) of those undergoing a second treatment modality had balloon dilation as their second treatment. Fifteen out of the 34 (44%) experienced some or great satisfaction. Seven out of 12 (55%) of the respondents who underwent Botox injection as their second form of treatment rated their satisfaction as some or great. Only 3 of the respondents chose life style and diet modification for their secondary treatment and all 3 indicated they received some form of relief. Eight out of 10 (80%) respondents who underwent myotomy as their second treatment option reported their satisfaction as some or great. Twenty-four out of 83 (29%) of the respondents chose not to receive secondary treatment or did not need a second treatment.

Although the number of respondents was small in both groups, our data indicated that myotomy satisfaction scores in both the primary and secondary treatment modalities offered respondents the greatest level of satisfaction.

Discussion

For uncommon disorders, it can be difficult to accumulate large cohorts of patients at single centers for study; thus, the Internet may be a valuable instrument to study these diseases. To our knowledge this is the first Internet-based study on the presenting symptoms of treated patients diagnosed with achalasia.

The Health Information National Trends Survey studied where patients go for health information. They found that patients sought health information 49.5% of the time from their physician first. In contrast, when asked where the patients actually went, 48.6% reported going on-line first, with only 10.9% going to their physician first [6]. This survey also revealed that 63% of the United States adult population reported going on-line in 2003 and, of those, 63.7% sought health information. This study also found, however, that only 3.9% of those seeking health information participated in a support group. Using this estimate, less than 800 people in the United States would be expected to participate in an achalasia on-line support group. The availability of the World Wide Web may change the dynamics between health care professional and patients, potentially resulting in more shared decision making [7].

One of the most promising aspects of the rise of e-health is the widespread availability of electronic peer to peer community venues [8]. These include Internet mailing lists, newsgroups, Web-based discussion forums, live chat rooms, use of Web-based surveys, on-line data capture, electronic medical records, and network analysis, which are also possible avenues of more efficient research utilities [9].

Lorig *et al.* [10] reported a unique approach to the use of an e-mail discussion group to improve health status and reduce health care costs in 2003. These investigators conducted a randomized controlled trial in chronic back pain sufferers. One group participated in an e-mail discussion group and received a book and a video about back pain treatment. The other group received a subscription to a non–health-related magazine. After 1 year, people using the e-mail discussion group had improved levels of pain, decreased disability, less health distress, and improved role function scores compared that of the control group [11]. This study was 1 of the first studies based on the use of an Internet support group for research and for patient benefit.

We examined the use of the Internet as a medical investigative tool for uncommon diseases by analyzing the presenting symptoms and treatments for achalasia in a cross-section of all members in internet support groups. The support category of message strings vastly outnumbered the remaining categories by at least a 4:1 ratio. This is not surprising; most people coming to a support group would be expected to discuss their ailments. The second most populated discussion string was that related to presenting symptoms. Members often asked each other about their personal symptoms and compared theirs to others in the group. The third most populated string was the treatment category in which some members asked others for treatment options, or discussed new technologies, compared treatment results, or sought advice on practitioners. Methods of diagnosis made up the smallest percentage of messages. Members asked questions on how others were diagnosed, how long it took to obtain the diagnosis, the number of the physicians they consulted before a diagnosis was rendered, and the possibilities of misdiagnosis.

We discovered that researchers and physicians can gain valuable information on what patients want from their providers by observing the strings of on-line messages exchanged. This method of observation allows patients to express their views and concerns in a nonthreatening manner. Protected by anonymity, the Internet allows patients to voice concerns with each other that they may not freely express to their physicians. For instance, several comments were made that respondents thought their physicians had diagnosed or treated them incorrectly. Instead of expressing this to their physicians, they sought second opinions, support from others, or performed independent on-line research.

Our survey examined a cross-section of respondents from the United States and 8 foreign countries. The response from across the globe and the data obtained in 1 month was impressive. One-center study bias and cultural bias was avoided because this study involved individuals from around the world. This form of study, however, is subject to other biases. Only those most concerned with their illness might join a support group. There may be socioeconomic bias because people in lower income levels may not have computer access and those that are not computer literate, such as the elderly, cannot participate in on-line discussions. Finally, we have no way to verify that all respondents had achalasia.

We found that the mean time to diagnosis was 4.4 years. This is similar to that reported by Eckardt *et al.* [5], who reported esophageal symptoms had been present a mean of 4.7 years before diagnosis. The median time from initial symptoms to establishing the diagnosis was 2 years. The median time may more accurately reflect what occurs in most patients by excluding those few outliers. It is possible that atypical or mild esophageal symptoms may deter the physician from considering the correct diagnosis in the early stages of achalasia. In fact, early achalasia commonly presents with chest pain and/or pyrosis [12–15], a symptom constellation that could potentially lead to alternative diagnoses such as cardiac disorders or gastroesophageal reflux disease. Additionally, severe, episodic chest pain dominates more typical symptoms such as dysphagia and regurgitation, thus leading to a delay in making an accurate diagnosis [3, 5].

Dysphagia, regurgitation, weight loss, and chest pain are the most common clinical features of achalasia [4]. Eckardt *et al.* [5] studied 87 consecutive patients with newly diagnosed achalasia to assess the duration and severity of symptoms in all newly diagnosed patients with achalasia. Out of the 87 patients, 98% reported some degree of dysphagia, 85% reported regurgitation, 77% reported chest pain, 65% reported weight loss, and 20% admitted to epigastric pain. Howard *et al.* [3], in an anonymous survey of 38 patients, found that 98% reported dysphagia, 74% reported chest pain, and 60% reported weight loss. These studies reported only on patients from a small geographic region. Our results are strikingly similar to these other studies, although our population had global representation. We believe that this further supports the use of the Internet in data assimilation of rare diseases.

Manometry is generally regarded as essential to the diagnosis of achalasia, yet we found more respondents underwent endoscopic evaluation. In fact, respondents reported manometry to be the least used diagnostic modality. From reviewing comments made in the survey, it appears that some of the patients underwent esophagogastroduodenoscopy first based on their symptoms. This is in agreement with Rosenzweig and Traube's [12] findings that achalasia often is initially misdiagnosed as gastroesophageal reflux disease. Another reason for the low frequency of manometry studies may be that the passing of the catheter is uncomfortable and the lack of sedation.

Achalasia treatment methods have advanced since Sir Thomas Willis first described the use of a sponged tip whalebone for esophageal dilatation in 1672 [16]. Noninvasive treatments consist of soft foods, sedatives, nitrates, anticholinergics, and calcium channel blockers. Patients who do not respond to these conservative treatment methods may be candidates for more invasive procedures. Traditional invasive treatments include Botox injection, pneumatic (balloon) dilation, and surgical myotomy. These therapies seek to reduce the lower esophageal sphincter pressure, allowing gravity to aid in esophageal clearance despite the absence of esophageal peristalsis.

Vaezi *et al.* [17] randomized 40 patients to either receive botulinum toxin or pneumatic dilation as treatment for achalasia. They found at 1 year that pneumatic dilation was more effective than botulinum injection by measuring reductions in symptom scores, lower esophageal sphincter pressure, esophageal barium height, and esophageal diameter. They quote a success rate of up to 90% with pneumatic dilation and 95% for myotomy [18]. Both of these therapeutic modalities are aimed at removing the functional barrier at the lower esophageal sphincter level [19]. The patients in our study reported the greatest satisfaction scores were given to these 2 modalities.

Zaninotto *et al.* [20] concluded that laparoscopic myotomy is as safe as botulinum injection, but that after 2 years only 34% of those receiving botulinum injection were symptom free versus 88% of those undergoing myotomy. Bansal *et al.* [21] randomized 34 patients to received pneumatic dilation or botulinum injection. Of those patients undergoing dilation, 89% reported remission in their symptoms after 3 months versus 38% of those undergoing botulinum injection. Again, the numbers of participants were small in these trials.

Ghoshal *et al.* [22] commented on conflicting trial results and attempted to compare botulinum injection and balloon dilation. They studied 17 patients treated over the study's 3-year time period. After 1 week, their data suggested that there was no difference in LES pressure or maximum esophageal diameter when comparing the 2 groups. Karamanolis *et al.* [23] performed a retrospective study to evaluate the long-term efficacy of pneumatic balloon dilation of 260 patients who were treated over a 20-year period. They concluded that 51% of patients continued to be in clinical remission more than 15 years after their initial dilation. Our respondents rated myotomy overall as the preferred treatment methodology, whether primary or secondary, for relief of symptoms.

Most patients with achalasia do respond to primary therapy, but our respondents' overall satisfaction rate was lower than reported in other studies. It could be assumed that most patients who seek information on the Internet do so because they have not done well with primary therapy. It is noteworthy, but not surprising, that most patients in the survey had at least 2 treatments, often with inadequate response.

Conclusions

Even though our Web survey was only posted for 1 month, we demonstrated that gathering data from Internet support groups was efficient. Our study was inexpensive and involved no monetary investment, yet achieved global outreach. One-center study bias and cultural bias was avoided, but this type of study is subject to other biases such as those most concerned with their illness might join a support group. Other biases include that those who lack computer access or are computer illiterate cannot participate in on-line discussions. It should also be noted that single-institution studies may not constitute a random sample and thus may have their own inherent biases. Finally, we had no way to verify that all respondents were accurately diagnosed with achalasia. Internet data gathering methods may become a more effective way to gain further knowledge of rare diseases.

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