

THE INTERNET AND MEDICINE: FOCUS ON PEDIATRIC SURGERY

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Rapid development of the Internet, which is the largest network of the connected computers, has resulted in free circulation of any kind of information all around the world. This immense network created a world without barriers, made easier communication possible between people, and has facilitated accessibility of information equally from anywhere in the world. The Internet is a tool that provides different kinds of communication options for the health professionals as well as the pediatric surgeons. There are many applications of the Internet for the use in medicine. Electronic mail (e-mail), which is the most widely used feature of the Internet, facilitates rapid, easy and cost effective communication between the physicians. Messages, and any kind of electronic documents can be transmitted by e-mail. E-mail makes possible the consultation on clinical cases, participation in distribution lists (mailing lists), databases and discussion forums. Another mostly used facility of the Internet; the World Wide Web (WWW) provides a user friendly interface with web pages. By a web page, it is possible to read texts, to watch images, video and real time pictures, and an audio embedded into the page can be listened, as well. WWW facilitates bibliographic research, and to access medical on-line journals. The Internet, which provided remarkable development in telemedicine, made possible the videoconferences, tele-consultations, and multicenter protocols. Surgical simulation and remote virtual surgery seem to be widely used applications of the Internet in the future. Recently, all these aforementioned facilities make easier for a health professional to reach information faster and also cheaper than the conventional communication methods. However, the Internet carried out many ethical problems such as patient's privacy rights and deleterious web sites which are serving invalid or misleading health information. Recently the Internet has become the millennium's conventional method of communication. A physician, as well as a pediatric surgeon who is familiar with the Internet will have a great ability to improve him or herself in medicine.

Keywords: Internet, medicine, pediatric surgery

INTRODUCTION

Last few years have seen extraordinary technological development in the world telecommunication. What used to be unthinkable due to distance is now possible. Frontiers are disappearing and information is circulating freely throughout the world. The development of the communication gave birth to a world without distances, and without barriers. Information services are equally and readily accessible from anywhere in the world. This easier communication is changing the relationships between people and most particularly between professional people. Medicine is a good example of such a profession. The new method of communication, which makes all these things possible, is the Internet.

The Internet is the largest network of connected computers exchanging physical links through a standard protocol (TCP/IP) of communication linked to each other by telephone lines, integrated services digital network lines, optical fibers and satellite links ^(1,2). Internet is not something tangible and concrete; it is not a supercomputer the function of which is to put computer users in contact with each other. But in reality, it is an immense network of computer networks, a worldwide consensus that information to be shared with everybody ⁽³⁾. The philosophy of the Internet is "If you have information of interest, share it with the others"

A BRIEF HISTORY

The birth of the Internet was in sixties, while cold war

was on between the USA and the USSR (4). At that time, ARPA (Advanced Research Project Agency) was created with purpose of designing a telecommunication network which could be resistant to a possible nuclear chaos (3). The original ARPA net was established in 1970 that networked major computers at four universities in the USA (4). By 1972, 40 computers had been connected to the ARPAnet. In 1974 a consensus was reached about the manner of transmission of information between two computers and the well known IP (Internet protocol) and TCP (Transmission Control Protocol) were born (3). Recently, number of the Internet users has increased progressively and today it is estimated to be 679.7 million over the world (5).

MOSTLY USED APPLICATIONS OF THE INTERNET

Electronic mail (e-mail)

Scientific collaboration among health professionals has evolved rapidly in the last few years toward the use a new type of communication: electronic mail (e-mail). E-mail is perhaps one of the most used applications of the Internet (6). E-mail permits easy, cheap, fast and convenient communication among the users of the Internet. A message can be sent using an e-mail program, which is supplied by the browser programs such as Microsoft Internet Explorer or Netscape Communicator. An e-mail can be sent or received by using many commercial web sites around the world which provide free e-mail accounts. It takes an average of a few seconds to a couple of minutes to reach to another computer node in very distant geographical zones. The message is stored by the Internet service provider until the e-mail owner retrieves the message.

E-mail has much superiority to conventional communication methods. E-mail is economic; transmission of the message costs as much as a local call fee, and the price is not depended on the distance. A few seconds or a couple of minutes are enough for a message to get to the mailbox of the address. Transmission time of a message is free of the distance of two computers. The use of electronic mail is very easy. Automatic transmission of the same letter is possible to hundreds of different addresses simultaneously. All kinds of electronic files can be transmitted by e-mail. Sending and receiving sound, graphics, images, or any file with multimedia format via an e-mail is currently possible.

E-mail distribution lists

The e-mail distribution lists, which are also known as "e-mail discussion groups, e-groups, listserv, mailing lists", are one of the mostly used e-mail based application of the Internet by physicians. The concept behind an e-mail discussion group is simply that of redistribution of an e-mail, which sent to a host computer, to all individual e-mail addresses that are subscribed to the mailing list. On the host

computer, there is list software running, usually Listserv or Majordomo (7). These softwares maintain the list of subscribed e-mail addresses. When a member wishes to send an e-mail to the other list members, he or she sends the message to the list address, and the software then sends out that message to all subscribed addresses. Using this application of the Internet has been permitting the exchange of information among physicians in a very rapid and effective way, keeping all members of the list up-to-date regarding the comments of the others.

There are basically two types of e-mail distribution lists: Moderated and unmoderated. In a moderated list, delivering of any message to the other list members is under the permission of the list owner. The list owner reads the all incoming mails. The mails that are refused to be sent are blocked by the list owner. The mails which are decided to be publishable are sent to the others. In a nonmoderated list, all messages that are sent to the message center are mailed to the registered members by the host computer without any supervision (1). Both moderated and unmoderated e-mail distribution lists maybe "closed list" where only registered users can send messages or "unclosed list" where anyone may send an e-mail without registration.

At present, any person can simply start a new e-mail group on an acknowledged subject. Many commercial web sites such as Yahoo Groups (8) offer easy methods for starting a new e-mail discussion group. The most popular e-mail list among the pediatric surgeons in the word is known as "PEDSURG" (9), which is formerly named Pedsurg-L (1). This discussion group was created in 1995 by Tom Whalen at the Division of Pediatric Surgery, University of Medicine and Dentistry of New Jersey (1). PEDSURG is a closed and unmoderated Internet e-mail distribution list to discuss clinical issues as well as standards of pediatric surgical practice. By January 2004, there was 791 medical staff registered to the list over the world (9). Any registered professional of pediatric surgery can pose questions on a specific condition, management of a problem or dilemma. A detailed information about the PEDSURG and subscription rules are available at the web site entitled "Yahoo! Groups: Pedsurg" (9).

In Turkey, there is an e-mail distribution list of Turkish Pediatric Surgeons. The list has been founded in 1998 by Tanju Aktug of Turkish Association of Pediatric Surgeons Internet Study Group. This e-mail distribution list is being widely used by Turkish pediatric surgeons not only for case discussions and exchanging ideas but also for announcements of future meetings etc.

On several disciplines of medicine, many discussion groups are exists. A directory of some of these e-mail lists can be found at the web site entitled "Yahoo! Groups: Health & Wellness" (10).

World Wide Web (WWW)

Birth of the World Wide Web (WWW) in 1989 was revolutionary development for the Internet. At first, the earliest WWW programs developed as screen based on text, but new programs such as Netscape Communicator, Microsoft Internet Explorer allow obtaining not only text but also images, sounds, videos and any multimedia document embedded in web pages. These abilities of WWW made it the most resourceful area of the Internet. Capability of the WWW is restricted with borders human imagination so it can be seen as an endless book. Each page has a unique address. This address is known as "Uniform Resource Locator" (URL) ⁽¹⁾. For instance, "http://www.taps.org" is the URL of the Turkish Association of Pediatric Surgeons. Many pediatric surgical clinics, associations and individual pediatric surgeons have been developed their own web sites, which offer huge informatics about the community and the science. URLs of some of such sites are shown in (Table 1& 2). In order to find out more Institutional web site addresses or any site on any subject on the Internet, WWW based commercial search engines can be used (Table 3).

Bibliographic research on the Internet

Bibliographic research is constant business of all practitioners and a pediatric surgeon, as well. Medline has been introduced to healthcare professionals for several years. Traditional Medline search is done by using a CD-ROM. The databases stored in CD-ROMs are updated every 3 to 6 months, thereby resulting in lack of the recent data. To perform a complete search on any subject beginning from 1966, the time that Medline records have been available first, a number of CD-ROMs have to be inserted in to the CD-ROM driver consecutively. It is apparent that this way of search is actually time consuming and expensive. After the Medline has become available on the Internet, all these disadvantages have been eliminated.

Medline is provided by the National Library of Medicine (NLM). The most popular Medline system is PubMed ⁽¹¹⁾. PubMed, a service of the National Library of Medicine, includes over 14 million citations for biomedical articles back to the 1950's. These citations are from Medline and additional life science journals. PubMed includes links to many sites providing full text articles and other related resources ⁽¹¹⁾. Using the search screen of PubMed makes possible to reach to the bibliographic details and abstracts of the related published papers in the journals that are indexed in the Medline. Searching is fast and simple. PubMed has also links to molecular biology databases of DNA/protein sequences and 3-D structure data ⁽¹¹⁾. A detailed description of the PubMed is available at web page entitled PubMed Overview ⁽¹²⁾

Medical publications on the Internet: E-journals, e-books

The conventional transmission of information on paper has remained unchanged over the last hundred years. It was until very few years ago, no alternative to this way of transmitting information existed. But gratefully to the proceeding in the computer technology and telecommunication, lots of medical journals and books are being electronically transmitted by the Internet.

The Internet has been provided lots of medical sources in the cyberspace. Electronic publication requires neither physical printing on paper nor transportation; it is carried out in an information medium which is easily accessible from anywhere in the world, and is permanent and updateable at any time. Electronic transmission of medical publications can be carried out in various ways. Today the scientific papers are mostly transmitted via the Internet in a web page format or in PDF files (in reprint format). The advantages of electronically accessible publications are as follows ⁽³⁾:

Limited cost: An electronic journal reduces paper consumption. Neither the printing, nor the post expenses are required.

Global access: By using the Internet, it is very easy to gain access any electronic journal. Access to a new issue of an e-journal is fast and possible anywhere on the planet.

High quality images: The internet makes possible not only transfer of the images of articles but also video and audio files. If embedded in web page, a reader can watch a surgical procedure and hear the hearth sounds of a patient.

Digital storage: No building or shelve is necessary for storage of journals. This is another issue of the cost effectiveness.

Provides interactivity: The authors and readers can communicate more easily and discuss effectively then it is in the traditional ways.

The possibility of reliable analysis of readership: Computerization of articles will also allow analysis of the impact of an article on its readers

Environment friendly: From the ecological point of view, the cost of this system is low. The less paper and ink are consumed the less the environmental hazards are occurred.

The majority of the classically printed journals also have electronic versions, i.e. Journal of Pediatric Surgery, Pediatric Surgery International and European Journal of Pediatric Surgery ⁽¹³⁻¹⁵⁾. Recently, many commercial information resources for accessing to medical journals and books have been available on the Internet ⁽¹⁶⁻¹⁸⁾. Some of these e-publications are for free, while a registration fee is

needed for the reminders. A list and links to the free journals can be accessed at "Free Medical Journals Site" which was created to promote the free availability of full text medical journals on the Internet ⁽¹⁹⁾. Stanford University Library's HighWire Press is another site where links are listed to the journals with free full-text articles, upcoming journals, journals with usage statistics online, pay-for-access sites, the largest free full-text science ⁽²⁰⁾. Another web site of interest for medical staff was generated by Medical College of Ohio, Raymon H. Mulford Library. This site is entitled "Instructions to Authors in the Health Sciences". This web site provides links to web sites which provide instructions to authors for over 3,500 journals in the health and life sciences ⁽²¹⁾.

Telemedicine

Telemedicine can be defined as the use of telecommunications to provide medical information and services ⁽²²⁾. thankfully to the Internet, the technology of transmission of all kinds of medical records has decreased in costs and complexity over the past few years. Until very near past, the Telemedicine was introduced as "It may be as simple as two health professionals discussing a case over the telephone, or as sophisticated as using satellite technology to broadcast a consultation between providers at facilities in two countries, using videoconferencing equipment" ⁽²³⁾. But recently, by the applications of the Internet, previously mentioned "sophisticated" system has become a "routine". Teleradiology, the sending of x-ray films, computerized tomography scans, etc. (store-and-forward images) is the most common application of telemedicine currently. Telepathology is another common use of this technology. Images of pathologic slides may be sent from one location to another for diagnostic consultation. Dermatology is also a widely used field of telemedicine with store and forward technology ^(23,24). Cardiology services have used telemedicine in a variety of ways. Telemonitoring of pacemakers and ECGs have been utilized for many years. Echocardiography can be viewed remotely by a specialist by either real time imagery or "store and forward" systems for later view ⁽²⁴⁾.

The other widely used technology, two-way interactive television, is used when a 'face-to-face' consultation is necessary. Videoconferencing equipments at both locations allow a 'real-time' consultation to take place ⁽²³⁾. With a small camera, a video-card and a soft-ware, a PC becomes a videoconferencing "media". Internet provides an easy and cheap connection between these "medias" located all over the world.

There are also many peripheral devices which can be attached to computers to aid in an interactive examination. For instance, an otoscope allows a physician to 'see' inside a patient's ear; a stethoscope allows the consulting physician to hear the patient's heartbeat ⁽²⁴⁾.

Providing healthcare services via telemedicine offers many advantages. It can make specialty care more accessible to underserved rural and urban populations. Video consultations from a rural clinic to a specialist can alleviate prohibitive travel and associated costs for patients. Videoconferencing also opens up new possibilities for continuing education or training for isolated or rural health practitioners, who may not be able to leave a rural practice to take part in professional meetings or educational opportunities ⁽²⁵⁾.

By using the Internet, both clinical consultation and actual operating room guidance have been utilized. As with other specialties, telemedicine allows remote surgeons to provide consultation in the local or international settings. Initial evaluation, follow-up visits, and multidisciplinary clinics have been utilized with good results.

An exciting research of telemedicine is telemanipulation. This utility is a possible application of the Internet. The military and some university research centers are involved in developing robotics equipment for telesurgery applications ⁽²⁴⁾.

Members of the community of pediatric surgery who are indeed very interested in the Internet, are widely using tele-consultation via e-mail or web based transmission. Telemedicine (or remote surgery) will surely replace many urgent calls within the pediatric surgery arena. We will be able to watch imaging digital studies' in-situ, instant-video with a camera of intraoperative findings, operative procedure, and see pathological frozen section in difficult cases. The pre-, intra- and postoperative consultation with expert in the field of the defined problem will be within the reach of a monitor connected to internet. Different institutions dealing each with expert problems of pediatric surgery (biliary atresia, congenital diaphragmatic hernia, to mention a few) will surely be within the reach of a click of the computer system.

ETHICAL CONSIDERATIONS

The Internet has the potential to enhance the professional relationship. But despite this promise, the medical environment raises important questions about legal and ethical property. Facilities on the internet may be abused. It must be always kept in mind that anyone can put any information on the Internet. The increased connectivity among people, computers, and organizations afforded by the Internet has come at the price of less privacy, and because of the limitations of technology this is unlikely to change soon ⁽²⁶⁾.

The quality of information in the web pages varies widely. Lots of the health information on the Internet is not "peer reviewed" and this causes some incomplete and in

correct information available on the net (27-28). Impicciatore et al analyzed patient-oriented web sites. Bogus professionals and world wide web sites with information of unknown validity have inappropriately advised members of the public, who may believe that such advice has sound scientific and clinical substance to it (29). Of 41 sites identified a that time, only 4 of them closely to published guidelines for home management of childhood fever and some pages proposed potentially dangerous remedies (30).

Messages coming from the medical e-mail discussion groups may include insufficient or wrong information. It is frequently impossible for readers of a listserver discussion to know the knowledge base and clinical skills and acumen of particular commentator. Therefore, readers of such commentary should be extraordinarily wary of incorporating advice or information into their own practice unless those insights only supplement information drawn from peer-reviewed journals or advice from physicians or surgeons whom they know and trust (31).

Patients may join discussion groups and seek information by using the Internet, as well. They obtain advice that sometimes seems to be given on the basis of little information or on questionable clinical grounds. Culver et al studied a discussion group for suffers of painful hand and arm conditions. In their review of more then 1600

consecutive messages posted through a 5-month period, they found that approximately 90% of the messages providing medical information were authored by persons without professional medical training, and approximately one third of all medical information provided could best recognized as "unconventional" (32).

In e-mail discussion groups the details of the cases are presented to everybody. This may be considered as an attack to privacy rights of the patients. Advices coming from e-mail groups or WWW may be inappropriate because the person or the web site, giving the advice, is in a different country and subject to different jurisdictions.

Finally; the Internet has become the dominant presence of the day. It has been developing rapidly and has revolutionized all aspects of the life. It is apparent that, in medicine and pediatric surgery, it will change performance of health professionals. The Internet can enhance and facilitate clinical care, research, teaching, and practical issues. It is apparent that future technical developments on computing will create further advances. A doctor should be familiar with the Internet in order to succeed better in medicine.

Table 1:. Selected pediatric surgical associations on the Internet (In alphabetical order, all sites were accessed on January 21, 2004)

<i>Name of the association</i>	<i>URL</i>
American Pediatric Surgical Association	http://www.ped-surg.org/
British Association of Paediatric Surgeons	http://www.baps.org.uk/
Canadian Association of Paediatric Surgeons	http://www.caps.ca/
German Society of Pediatric Surgeons	http://www.dgkic.de/
The Egyptian Association of Paediatric Surgeons	http://www.eaps.org.eg/
The Japanese Society of Pediatric Surgeons	http://www.jsps.md.tsukuba.ac.jp/nonnative/index_e.html
Turkish Association of Pediatric Surgeons	http://tccd.org/

Table 2:. Selected URLs of the web pages of pediatric surgical interest (All sites were accessed on January 2, 2001)

<i>Title of the web page and origin</i>	<i>Area of specialty</i>	<i>URL</i>
Virtual Children's Hospital, USA	A digital health sciences library created	http://www.vh.org/pediatric/index.html
Health On the Net Foundation, Switzerland	A non-profit organization built to support the international health and medical community on the Internet	http://www.hon.ch/
Pediatric Surgery Handbook, Puerto Rico	Includes brief notes on pediatric surgery for residents and medical students	http://home.coqui.net/titolugo/handbook.htm
The Pull-thru Network, USA	Dedicated to the support and information needs of the families of children born with imperforate anus, cloaca extrophy, Hirschsprung's Disease etc.	http://www.pullthrough.org/
Pediatric Surgery, MedMark, South Korea	Includes links to pediatric surgery related web pages	http://www.medmark.org/peds/
Circumcision Online, USA	Circumcision information explained by doctors, medical establishments and researchers	http://www.geocities.com/HotSprings/2754/
The Children's Oncology Group, USA	To cure and prevent childhood and adolescent cancer through scientific discovery and compassionate care.	http://www.childrensoncologygroup.org/

Table 3:. Some famous search engines and their URLs (In alphabetical order, all sites were accessed on January 21, 2004)

<i>Search Engine</i>	<i>URL</i>
Altavista	http://www.altavista.com
Excite	http://www.excite.com
Google	http://www.google.com
Lycos	http://www.lycos.com
Yahoo	http://www.yahoo.com

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