Original article

Use of the Internet and information technology for surgeons and surgical research

Mark T Cartmell, Andrew N Kingsnorth

Department of Surgery, Plymouth Postgraduate Medical School, Derriford Hospital, Plymouth, UK

The recent, and extensive, expansion in the use of computers and the Internet offers great potential for benefit in surgical research and, increasingly, surgical practice. However, in addition to the usefulness of information technology, much time can be spent achieving little and the potential missed because of the complexity and excess of information available. In this article, we examine some useful areas relevant to surgeons and surgical research, such as Internet service provision and E-mail, databases, medical Websites, and potential future directions.

Key words: Information technology – Internet – Surgery

The recent, and extensive, expansion in the use of computers and the Internet offers great potential for benefit in surgical research and, increasingly, surgical practice. However, in addition to the usefulness of information technology, much time can be spent achieving little and the potential missed because of the complexity and excess of information available. In this article, we examine some areas relevant to surgical research within the Internet and other applications of information technology. Inevitably, in an area so vast, only a few specific websites can be highlighted.

Internet service providers

Access, via a telephone line connection, to the Internet and World Wide Web (WWW) is provided by an Internet service provider (ISP or server). A number of options exist, including free Internet access, where one pays only the phone bill, normally via a local rate number. This is the basic 'free' ISP package, which is probably the best for users who spend a limited time on the Internet. A detailed list of free ISPs can be

accessed at <www.uk-bargains.co.uk/free-internet.html>. The best known and largest is <www.freesevice.com>. Another option is to pay a tariff but get various deals on phone connection to the ISP, for example, completely free (no phone bill) off-peak or even 24 h connections (e.g. <www.btinternet.co.uk>). Within a hospital or university network, the Internet connection (server) will normally be provided 'in-house'.

E-mail

E-mail pre-dates the WWW and even the Internet. An E-mail address is normally provided by your ISP, or the institution where you work. Another group of E-mail providers are Web based, allowing access from any computer with a Web connection, e.g. <www.hotmail.com>. In addition, many of the ISP E-mail addresses are now accessible from anywhere on the Internet (accessed via the ISP's home page). Other sources of E-mail addresses include medical Web sites (see below).

Correspondence to: Prof. Andrew N Kingsnorth, Department of Surgery, Plymouth Postgraduate Medical School, Derriford Hospital, Plymouth, UK

E-mail is not a complete replacement of traditional alternatives such as mail services, telephone and fax. However, it provides the ability to send a message (plus 'attached' documents) and have it arrive anywhere in the world within seconds for the cost of a very brief telephone connection; in addition, the message can easily be sent to multiple recipients. Many journals (e.g. *Gastroenterology*) and meetings (e.g. the Pancreatic Society of Great Britain and Ireland 2000) now accept E-mail submissions, not supported by a hard copy.

YAC

Another new development in contactability (if you desire that) is a, so-called, YAC (your always connected) number. This is a company (<www.yac.com>) which provides a number to which all forms of messaging can be sent. To you the service is free; the provider makes its money because the number, when called, charges at a mobile phone tariff.

Calls and faxes can then be routed to a given phone or fax; as selected by telephone or the Internet. However, perhaps most usefully, each can be directed to an E-mail address. Thus, a fax appears in your E-mail (which also enables you to obtain a digital copy of a document); in addition, calls to your number can appear as audio

attachments to your E-mail. These can then be retrieved from anywhere your E-mail is accessible.

Medline and associated databases

Use of Medline and associated databases has all but replaced flicking through *Index Medicus* and now enables simple and complex searches to be made with relative ease. Also it provides, in the majority of cases, an abstract which may provide the information required or allow assessment as to whether the full article should be sought. Medline and similar services can now be accessed via the Internet without the need to visit a library.

Free access can be found via a number of sites including the US National Library of Medicine, which is the home of Medline (<www.ncbi.nlm.nih.gov>; Fig. 1). Also here, PubMed (which includes Medline) can be searched through Entrez, which can combine searches for literature, nucleotide sequence, protein structure, etc.

The majority of medical websites, discussed later, provide access to a Medline search. Some provide regular E-mail updates on your designated database searches; the search is left activated and details of any new articles published on the subject will be automatically delivered to your E-mail. This service is available through the PubMed searches provided by <www.doctors.net.uk>.

Figure 1 The PubMed website at the US National Library of Medicine. The home of Medline.

Natural language and Boolean searches can be used. We find Boolean searches most useful where AND and OR are used to combine searches for more than one term (at PubMed 'AND' is automatically assumed at a space between words, and can be over-ridden by stating the appropriate Boolean operator in capitals or enclosing the phrase in parentheses). These are especially useful for more complex searches, *e.g.* tropical AND (pancreatitis OR diabetes) to enable you to pick up more articles on the diabetic aspect of tropical chronic pancreatitis. Author searches can be useful for following a series of work. Although a simple way of finding a number of articles on a topic (once an author's area of interest is known), this can skew your reading of the literature considerably, as can date limits.

Medical websites

Medical websites for the medical profession

A plethora of medical websites have sprung up and offer a range of services. The majority are free, funding themselves through advertising, *etc.* as the price of membership.

An example is Medscape <www.medscape.com>, a US-based site which provides Medline access and home pages

relevant to a subscriber's speciality, involving regular summaries of recent advances (which can be regularly E-mailed to you) and CME (continuing medical education). A similar concept, but British-based, is <www.doctors.net.uk>. Again Medline, discussion forums and E-mail services are provided, although not the same level of summaries and updates as Medscape. This site now provides a storage facility for documents allowing world-wide access to your documents without carrying floppy disks or a laptop.

The Royal College of Surgeons of England (<www.rcseng.ac.uk>), along with other Royal Colleges, has its own website providing fellows (and members) with information and services in addition to areas accessible to and designed for the general public (Fig. 2). For example, the library section includes information and links on evidence based surgery and databases (including the Cochrane database), as previously discussed.¹

Academic and hospital websites

University and hospital websites can provide insights into the activities of the given organisation and enable contact to be made with investigators who have similar interests, for example <www.ppm.plymouth.ac.uk>.

Figure 2 The Royal College of Surgeons of England home page. Designed for access by the public and surgeons alike.

Medical websites for the general public (so-called cybermedicine)

Patients are now able to access detailed information with ease, through the Internet, on their symptoms and medical condition. Such information provides potentially great benefit to the patient. However, it can also provide a skewed view of the facts and can cause considerable anxiety. In addition, this increased accessibility is a challenge to the profession to pitch their advice at the level of knowledge appropriate for the patient. The issues raised (both improved knowledge and possible misinformation) must be confronted, not least recent developments and issues of concern in the public domain, of which the patient may well be aware.

Websites in this category fall into three main groups:

1. Sites specifically for lay people interested in health issues or seeking advice on a topic.
2. Medical websites, part or all of which are open to and designed for the general public (which of course includes Medline, as well as sites such as the College site [Figs 3 & 4] and the British Medical Association).
3. Organisation/personal home pages for people with an interest in a given disease.

Personal websites

With the availability of free webspace from many ISPs and ever-cheaper domain names (.com, .co.uk, etc.) personal websites are becoming increasingly common.

Personal websites can be easily created, including hyperlinks to others pages within the site and to other websites. The many website construction packages (such as Microsoft Front Page) make this possible without knowledge of html (hypertext mark-up language). They can then be 'posted' onto your 'webspace'. For an example of use of hyperlinks from an article to abstracts and comments, to enable access to more information on referenced topics visit <www.cartmellsreferences.freemove.co.uk>.

Journal websites

Many journals have websites, although the scope of them varies greatly. The majority give contents and some supply full text to subscribers. Many will E-mail contents' lists on request along with some summaries (e.g. <www.nature.com>).

Some journals provide full-text online free (e.g. <www.bmj.com>). Still other journals (an area early in its development) are solely available online such as the *Journal of the Pancreas* (<www.joplink.net>). These advances provide full-text access, free (potentially rapid) submission and publication. A list of, and links to, journals with full-text free online can be found at <www.freemedicaljournals.com>.

Figure 3 The College coat of arms, saved as a JPEG file from the College website. To save a picture from a website right click on the picture and then click 'Save Picture As...' to select where to save it. Obviously if you are going to use it in any publication, etc. permission should be sought.

Figure 4 Another picture taken from the College website. This time of John Hunter the 'father of scientific surgery'.

Personal reference databases

These are software packages which enable you to create your own databases of journal articles, etc. In these packages, such as Reference Manager (ISI ResearchSoft, CA, USA, <www.refman.com>; in the UK from <www.bilaney.com>), you can type in and store details of a reference. You can also download directly from a Medline search enabling formation of a database including abstracts, keywords and notes, which you can also add. It can then be searched like a Medline search.

A further use is that, when writing, references can be inserted into that article. When the article has been written, the bibliography and in text citations can be automatically formatted to custom specifications or to the specifications of a given journal.

Other software

Many readers will be aware of word processing packages, spreadsheets and presentation packages such as PowerPoint. These will not be addressed in depth. Spread sheets and databases can be used to store research data

(e.g. clinical data and research results). PowerPoint will allow easy construction of a presentation and (perhaps most importantly) allow easy alteration, following a practice run, prior to creation of a hard copy, if required.

Software in clinical practice

Early developments in the use of software in decision making are being made. An example from our institution is an obstetric decision support programme, employing a decision making algorithm using a detailed set of research-based rules. It then reads, in real-time, a cardiotocograph (CTG) plus inputs of requested investigations. On these, it then bases advice for further investigations or interventions, as appropriate. It works as a support to patient management.^{2,3}

The (near) future

Neural networks will, we believe, find increasing applications in surgical research, as aids to putting together all information on complex issues such as aetiopathogenesis or prognosis. For example, in a condition of varied and multifactorial pathogenesis, neural networks could be designed and given all present data with the appropriate weighting of evidence (e.g. on the number of studies, power of those studies and statistical significance of an association).

New evidence could then be incorporated as it arose. The neural network could evaluate the weight of the new evidence based on given rules. If prior evidence exists the neural network could evaluate the relevance of the new

evidence in light of that which exists. The overall model could then update itself and the weightings given to already existing evidence in all areas. Functioning similarly to constantly updating, interrelated meta-analyses. Thus a model of aetiopathogenesis or prognostication could be created and continuously up-dateable.

Conclusions

The Internet and information technology present great opportunities, if some risks. The challenge is to use those parts that are useful without being bogged down in the complexities.

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