

Recent Advances in Russian Telemedicine

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Recent developments in a field of computer telecommunications bring new features to practical public health services. During the last several years many Russian hospitals and medical institutions became connected to the Internet or even have possibilities of ISDN-based videoconference facilities.

Most of European countries are characterized by good-developed high-speed telecommunications lines, which provide excellent basis for real-time teleconsultations. Our experience leads us to conclude that Internet-based videoconferences (Mbone, NetMeeting, ShowMe etc.) can not meet the medical requirements and only ISDN-based videoconferences could be assumed as a good choice of quality and prices. At the same time more than 80 per cents of total teleconsultations do not need urgent response and could be realized as delayed medical teleconsultations. The latter perform on Web- or e-mail-based transfer of medical information from remote areas. We discuss the problems and limitations of these kinds of telemedical consultations.

Several points of telemedicine activities in Russian Federation have been described, with different technologies used. It became obvious that the next steps of common work in Russian telemedicine will be efforts turned on standardization and integration of these initiative groups in the whole territory of all ex-USSR countries.

KEY WORDS: *Telemedicine, Teleconsultations; Internet-based videoconferences*

INTRODUCTION

One of the most impressive features of our days is rapid development of computer networks, which creates premises for their introduction and application in practical public health services. This means that medical information could be easily transferred from one computer to another connected to network in few seconds to almost any point of the globe. The value of this is difficult to overestimate: very often it is necessary for doctor to consult the patient living remotely in other place of the country or the world, or to help the patient located far from qualified medical services. Russia is of special interest in this context, because main medical specialists are concentrated in such large cities like Moscow and St.-Petersburg. Telecommunication infrastructure in medicine directly influences on telemedicine services' spread. During the last several years many Russian hospitals and medical institutions became connected to the Internet, sometimes using very high-speed links.

Historically telemedicine in Russia began from manned space flight exploration. Telemetry during space flight utilised more than 10 different physiological parameters monitored permanently. Therefore it was not surprising that Institute for Biomedical prob-

lems have been involved in the first telemedical project. At the same time, the main approaches applied to the space flight monitoring successfully used in earth telemedicine applications. First application of telemedical approach was strictly connected with tragic events caused by earthquake in Armenia in 1988 and with gas explosion in Ufa in June 1989. The only goal of this international project was to arrange help in remote consultation to many victims of this tragedy. During 12 weeks of organised television spacebridge 209 teleconsultations have been made on about 20 medical specialities. Based on these consultations many diagnosis and treatments have been changed.

Taking into account the positive experience, new demo project has been performed in 1993, which included 22 videoconferences between 4 American medical centers and more than 15 leading Russian medial centers. Remarkable feature of this project was partial use of multimedia computers together with real time television translation.

Since December 1996 in Telemedicine laboratory of Space Biomedical Center for Training and Research together with Faculty of fundamental medicine of Moscow State University began regular telemedical consultation through Internet between Russian clinics and American medical centers (Yale University, Baylor College of Medicine). Several tasks have been stated during organization of Telemedicine laboratory:

- * Formation the federal telemedicine service concept of Russia,
- * Analysis and development network infrastructure of Russian telemedicine service,
- * Development of electronic health records based on Russian

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standards,

* Searching new telecommunication technologies for further application in telemedicine,

* Development of methodological approaches for realisation of telemedical consultations in real time mode,

* Projection and construction of first Russian server for telemedical consultation in delayed mode, based on WWW-technologies,

* Development of education program on telemedicine for medical students and for continuous medical education of medical practitioners.

While in European countries high-speed communication lines are usually used for telemedicine application, providing a good basis for real-time teleconsultation, telecommunications in Russia mostly, could be characterised as low speed connections with corresponding limitations. The development of fibre optic networks is now just at starting point of growing and mainly are present in large cities of Russia like Moscow and St-Petersburg. Therefore, low speed network services like e-mail and others based on modem connections could be assumed to be of great importance in application for telemedicine in Russian Federation and the countries of former Soviet Union. At the same time, the modern information techniques based on Web-technology and high-speed telecommunications which allow to send real audio and video through the net could be applied in large cities where the most intellectual medical forces are presented.

Telemedicine as a medical service is mainly based on well-developed telecommunication infrastructure. During last several years, computer telecommunications and their applications in a field of public health services have been greatly increased. Recent progress allows transferring all kinds of medical information through computer networks.

Despite the fact that Russia was first country pioneering an exploration of outer space, development of ground telecommunications in Russia has been started just several years ago. During last five years new fibre optic lines have been created in large cities of Russia like Moscow and St-Petersburg, although the situation in small towns of regional centres are still the same as it was 10 years before. The main communications there are still standard copper phone lines. Although these lines are well developed, the quality (speed) of data transmission is suitable just only for low speed digital traffic like e-mail. These lines could be also used to organise Internet access through dial-up facilities. Much better situation in large cities of Russia - Moscow and St-Petersburg, where fibre optic lines became real.

Growth of Internet service providers' (ISP) number providing both leased line access and dial-up connections to the Internet has been observed during last years. Total number of ISP at the present time in former USSR is around 400. Only 21% Internet

providers are working besides Russian Federation. As concerned Russia, about 59% of ISP's provide their services in small regional towns, mainly in regional capitals. Remained 20% of ISP's are working in Moscow and St-Petersburg (1).

The information about how various medical organisations are connected to the Internet was found to be difficult to obtain although the official information is available on Web-site of Ministry of Public Health of Russia (2). Sometimes it can be explained by the fact that there are a lot of clinical organisations where Internet access is organised on private basis by advanced medical personnel and often for their own money. Major part of medical organisations having Internet access represents different regional cities of Russian Federation and just only 11% and 7% belongs to Moscow and St-Petersburg accordingly. This fact could be assumed as a good sign for spreading of telemedicine technology in future.

In large cities (Moscow, St-Petersburg, Tula, Arkhangelsk and others) phone companies of Russia offer new kind of services like ISDN (Integrated Services Digital Network). Therefore, the state of telecommunications in Russia could be characterised by following features:

* Well developed, but low speed copper phone line suitable for digital connections up to 33,6 Kbps.

* New digital telecommunication services available mainly in large cities of Russia.

* Financial problems in medical organisations of Russia making difficulty to apply new information technologies in clinics.

Despite this, several points of telemedicine activities are evident in different medical organisations of Russia.

RESULTS AND DISCUSSION

1. Delayed telemedical consultations.

This kind of teleconsultation could be easily performed using low speed transfer of medical information from one computer to other through modems connecting directly two computers or via e-mail. In Telemedicine laboratory of Space Biomedical Center for Training and Research we tested usefulness of BBS (Bulletin Board System) station to support telemedical consultations in delayed mode and concluded that in situation when just only low speed connection available, this approach could be a choice for teleconsultation purpose.

Transmission of medical information through e-mail is a good example of telemedical application at low speed connections. This could be realized both connecting to Internet service provider and organizing Intranet based on leased phone line. The latter is widely explored in Child Telemedicine Center in Moscow. E-mail

exchange(s) in this case is followed by "on-line" telephone session (3). This approach could be assumed as a good low cost solution for teleconsultation if no live video is transmitted. Information technologies based on World Wide Web (WWW) provide much more possibilities for corporate work. The main advantage of this technology is multiple access to Web-server at the same time that allows to perform the service like "teleconcilium", where many physicians could participate in discussion together in order to specify the diagnosis and methods of treatment. Since January 1998 in Space Biomedical Center for Training and Research (SBC) the mirror Web-server specially designed for posting clinical cases and further evaluation by other side has been installed (Fig.1). These cases' database is permanently added and renewed. This project "Telemedicine Spacebridge to Russia" was started under the guidance of NASA.



Figure 1. General view on NASA of home page at mirror WWW-site in SBC

This Web-site was developed firstly by NASA for international telemedical consultations between American and Russian physicians. Furthermore, we use it for training the students of Faculty of Basic Medicine of Moscow State University in new organized "Telemedicine" course.

During the next two years many medical organizations have been connected to Space Biomedical Center:

1. President Medical Center of Russian Federation,
2. Central Hospital of Moscow Inferior Department,
3. Central Institute of Traumatology and Orthopedics,
4. Cardiology Department of Moscow Medical Academy,
5. Hematological Scientific Center,
6. Moscow Neurosis Clinic and many others.

We revealed the following problems working with American colleagues:

* Although the Web interface of WWW-server "Space Bridge to Russia" was very friendly, the structure of database has differed from Russian one.

* American physicians were often used abbreviations, which are very complicated to accept.

* There was necessary to standardize common clinical terms and expressions.

* Sometimes there was not enough space in Web-forms to post all medical information needed for given patient.

* Great disadvantage was inability for physician to add and renew information afterwards.

* The multimedia files like short movie (more than 5-6 Mbytes) could not be posted because of low speed communication channels in Russia.

These reasons lead us to the conclusion to develop Russian-language based Web-site, which takes into account peculiarities of Russian medical services and accepted forms. Since 1998 we have started to work under the project of WWW-site for delayed telemedical consultation for Russian clinics. This Web-server adequate to specific Russian medical requirements has been developed and tested in SBC. More than hundred telemedical consultations have been performed to the present time on different medical specialities (4,5).

2. Telemedical consultations in real time.

It is well known that transmission of live video and audio for real time teleconsultation needs high speed telecommunication lines. We tested various videoconferencing software for Internet application (Mbone, NetMeeting, ShowMe etc.) for "point to point" or "multipoint" modes and made the conclusion that the Internet can not provide enough bandwidth for medical purpose although it would be very attractive from cost effective point of view (Fig.2).



Figure 2. Screenshot made during multipoint telemedical consultation between Fundamental Faculty of Moscow State University, Yale University and Jonson Space Center using Mbone technology

More reliable and more qualitative teleconsultations could be achieved utilising ISDN-lines which are based on existing phone lines. We tested one BRI-ISDN line for organisation of "on-line" sessions with Moscow Clinical Hospital No.23 (fig.3). On more than 30 sessions we revealed that large shared applications like "WinWord" or "PowerPoint" run very slowly when one ISDN line is used. If more qualitative video needed, more ISDN lines would be recommended.

It should be said that ISDN service are growing very fast in Russia, where more than 20 regional towns can already be connected trough ISDN.

In 1997 the project exploring of videoconferencing tools in medical consultations started in Cardiovascular Scientific Centre and Institute of Surgery of Russian Academy of Medical Science. Since that time 16 clinical cases mainly on heart diseases presented from several regional towns have been consulted in real mode using ISDN lines (6).



Figure 3. Discussion of muscle histological section during real time teleconsultation using BRI-ISDN line between SBC and Moscow hospital No.23

Russian Medical Radiological Research Centre located near Moscow in Obninsk had activities with videoconferences, which were aimed to consult the patients suffered from Chernobyl accident (9).

DISCUSSION

The development of telemedicine service is strongly dependent on telecommunication infrastructure in general. The whole world is going to information society. Information technologies are now introducing into every day clinical work. Therefore, telemedicine attracts more and more attention of medical managers and clinical practitioners. Our experience revealed a lot of organisation problems caused by financial deficit and human factor. Based on experience of other countries with well-developed telecommuni-

cation infrastructure, initial groups in various medical organisations working in a field of telemedicine are now appeared in Russian Federation. It is obvious that the next step will be work on standardization and integration of these initiative groups into common telemedicine service in the whole territory of Russia and other ex-USSR countries.

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