Setting up a teleradiology network in a tertiary care neuroradiology unit: Problems, pitfalls, and solutions

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Learning objectives

To get an overview of the aspects to consider when setting up a teleradiology network with special regard to organizational, legal and technical issues.

To learn about potential problems and ways to avoid or to solve them.

We report from our own experience as a specialized neuroradiology department in a tertiary care university hospital. Although local legislation plays a certain role in these considerations, we hope that other institutions can profit from our experience. (Practical tips are marked in the text.)

Background

What is, and how do we perform, "teleradiology"?

Teleradiology is part of the more general concept of telemedicine, i.e., the "use of telecommunications technologies to provide medical information and services" [1]. Much has been written, projected and planned about telemedicine; a recent analysis, however, comes to the conclusion that "teleradiology is the only widespread telemedicine application" [2]. This may be due to the fact that radiologists have always been at the forefront of introducing new technologies; the German journal "Der Radiologe" dedicated one issue to teleradiology already more than 15 years ago [3].

There are different ways to implement teleradiology services: There is what we call teleconsulting, i.e., getting an expert opinion about a case from a more experienced or specialized colleague in the field, and "classic" teleradiology, where an exam is performed at a site where no radiologist is present and the reading/reporting is performed at a remote site ("second opinion" vs. "central reading" [4]).

A teleradiology facility should provide both services so that external hospitals with small radiology departments can, e.g., get an expert opinion during their daily routine as well as have their night/weekend emergency exams read by an experienced colleague remotely without having to invest in manpower on-site.

Imaging findings OR Procedure details
Why we set up a teleradiology service

After the installation of a hospital-wide PACS at our institution in 2003, it didn't take long until the first peripheral hospitals were connected to our PACS to allow for easy transfer of images. These transfers, though technically easy to perform while observing the rules of data security, were rather un-organized; the radiology department was not even always aware of the fact that images had been sent from a remote hospital. It was, however, simple for the external partners as it didn't require more effort than a click on "send to ..." in their own PACS.

An expertise from our in-house legal service came to the conclusion that this situation could not be tolerated and that a somewhat more restrictive, organized form of transfer had to be found. Simultaneously, a Neurocentre was founded at our hospital, and in the course of this project, a sub-project "teleradiology" was created.

Tip # 1:

When setting up a teleradiology project, look for the most effective mixture of professionals from different fields in your project group. Our "core group" consists of radiology professionals (physician and technician), a departmental IT specialist as project leader, and an experienced MBA who deals with business/administrative matters.

Additional specialists from the hospital's central IT, accounting department, legal services, alliance management, etc. are called in when needed.

How we set up a teleradiology service

It was decided to standardize the request for primary reports (initial reading) and secondary reports (expert opinion) from an external hospital by the introduction of a web-based form. As we did not find anything suitable on the market, we developed this ourselves in cooperation with a software company that already had a track record in the development of medical applications.

One issue that should be mentioned is that the legal framework in which you are moving when you decide to organize a teleradiology network is markedly different in different countries. While in some countries, e.g., Germany, teleradiology is regulated in detail [5], Switzerland has no such unified legislation. Instead, numerous federal and cantonal (state) laws apply; especially legislation regarding health services is mostly in the responsibility of the cantons [6]. Recent federal legislation has focused on electronic patient files and health insurance cards [7].

Implementation - in-house
Requests for - primary or secondary - reports that arrive via the webtool are handled separately from "normal" web traffic by our hospital’s server: Any incoming request is immediately shown in the webtool. Furthermore, a message is sent to a pager which is carried 24/7 by the resident on duty, and an additional alarm is triggered on a W-LAN-telephone that is also guarded 24/7. This makes sure that external requests with "emergency" status are handled immediately around the clock. (If an emergency request is not acknowledged in the webtool on our side after ten minutes, both devices - pager and telephone - sound a special "reminder alarm.")

**Implementation - external partners**

For our external partners who had been used for years to simply send images and discuss everything on the phone, the introduction of the webtool that routinely asks for numerous data meant a certain change of their workflow.

As expected, there were complaints why we "had to make everything so difficult now." Furthermore, users have to identify themselves before they can use this tool which means an additional step in the whole process on their side. While we prefer VPN connections that, once established, allow for an unlimited amount of data traffic without additional cost, some of our partners were already linked to commercial medical data networks and asked to use these. One issue that went mostly unchallenged was the financial compensation: We agreed on a tariff that barely covers our running cost, but teleradiology is a service for our colleagues that helps to establish new and intensify existing networks.

We could solve all of these problems in direct conversation: The core group made on-site visits to all external partner hospitals to present the project and the idea behind it and to train our partners in using the webtool.

**Tip # 2:**

*Make the whole process as easy as possible for your partners. During the on-site visits, we were often asked "Who shall have the permission to send pictures to you for reporting?". Our answer was always the same: "Please handle this as you think appropriate. We don’t know how you are organized, and we don't want to interfere with your organisation."

*It really doesn't matter whether only senior staff members or first-year residents can send pictures - we provide a service, and we want to have satisfied partners. No need to erect unnecessary obstacles!*

**The webtool**
As our primary means of communication, the webtool is a key issue of the project. It may look quite simple, but its design cost the core group and the software company more time than all on-site visits taken together. What is so special about a web form with some checkboxes and text fields?

As the whole referral-and-reading process leaves no "paper trail," the webtool has to provide legally valid documentation. This means that

- every single action (what was done by whom, and when) has to be reflected in the user interface, and the complete process has to be documented in detail including precise timestamps. This documentation must be protected against manipulation.
- all relevant information that is sent from one party to the other must be documented.
- the webtool has to provide all the information that a radiologist finds on a "normal" referral form including questions regarding pregnancy, kidney function, possible drug interaction/allergies, previous studies etc. Furthermore, for a "tele-referral," completeness of data sent is an important issue.

The current version of our webtool is shown in the figures; the images guide you through a primary reporting process (all names are fictitious) with views of the webtool on our side (DIN: University Institute of Diagnostic and Interventional Neuroradiology) and at the partner's site (Partnerspital: partner hospital). Switzerland is multi-lingual; we offer French, German, and Italian versions as these are official languages. We added English to make use of the tool easier for foreign colleagues.

**Tip # 3:**

*The reading radiologists in our hospital consider the referrer's phone number one of the most important data in the web form. The old rule "before you reach for the dictaphone, reach for the telephone" is still valid, even in times of teleradiology services. Needless to say that your external partners always welcome a personal communication; all information gathered in a conversation has to be added to the final report with an appropriate remark. In this respect, teleradiology is not different from your routine clinical work.*

**Images for this section:**
Fig. 1: The external partner's start screen. Here, all current procedures (primary or secondary reports) are shown. ("Image transfers" is a purely administrative option that does not require a radiologist's interaction.)

Fig. 2: On the next screen, the external partner can select the requested teleradiological service.
**Fig. 3:** The most important screen: On top, the referring physician’s contact data are given, then follows the section with the relevant patient-related data.
Fig. 4: The web form requires the same kind of information that is usually found on referral forms on paper.
**Fig. 5:** When the external partner has completed and sent the form via the webtool, the alarm goes off at our hospital. When logging in, our radiologist sees this screen with a new order.

**Fig. 6:** Any incoming order has to be explicitly accepted. The exact time is recorded and stored, as all other data, in an automatically generated, non-editable PDF file.
Fig. 7: If an initial (primary) report is requested, our radiologist first sends the protocol that he wants performed. These protocols were individually defined for each of the external partners depending on their CT and/or MR scanners; the webtool offers only what is available at the respective requesting site.

Fig. 8: The remote site sends the images when the study is complete.
Fig. 9: When the report has been dictated and approved (we use automatic speech recognition to speed up report writing around the clock), our radiologist gives his OK in this screen. The report is then sent to a pre-defined email address at the remote site via a secure server.

Fig. 10: The Bernese teleradiology network (January 2013).
Conclusion

Installation of a teleradiology network is a win-win-affair:

The centre acquires referring partners, the external hospitals have expert knowledge available around the clock, and they can even save by reducing their on-site presence of radiologists.

Our teleradiology network has started operation in January 2012; the current situation regarding affiliated hospitals is shown in the map.

Last not least, patients profit from such installations as they can be sure to get an expert opinion (e.g., in case of stroke) even when they are initially admitted to a smaller county hospital.

Images for this section:

Fig. 10: The Bernese teleradiology network (January 2013).
References

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Personal Information

If you are interested in our project in general or if you have a specific problem and would like to know how we have dealt with this situation, please don't hesitate to contact our project group.