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Hemodialysis in isolated areas: contribution of telemedicine and analysis of specific issues

L'hémodialyse en territoire isolé :
apport de la télémedecine et analyse des problématiques spécifiques

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Résumé

La télémedecine appliquée à la dialyse chronique a connu ses balbutiements à partir de 2010. L'expérience d'un territoire éloigné et isolé est rapportée avec un recul de six années. Le nombre de patients traités est très faible, les différents aspects pratiques sont abordés : la liaison informatique technique, la maintenance biomédicale et les contrôles qualités, le suivi du parcours de soins des patients porteurs d'une maladie rénale chronique (MRC) et le rôle fondamental des soignants. Pour tous, il s'agit d'une activité extrêmement enrichissante.

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Mots clés : télémedecine, dialyse autonome, outremer

Abréviations :

ECHO Expansion de Centres d'Hémodialyse de l'Ouest
(association gérant la dialyse à domicile)

IDE : D'Infirmière diplômée d'Etat

MRC : Maladie Rénale Chronique

UDM : Unité de Dialyse Médicalisée

FAV Fistule Arterio Veineuse

DSI : Directeur Service Informatique

Summary

Telemedicine's application to chronic dialysis had its beginnings in 2010. The experience of a remote and isolated territory is reported with a background of six years. The number of patients treated is very low, but various practical aspects are addressed: technical IT liaison, biomedical maintenance and quality controls, monitoring the care pathway of patients with chronic renal disease (CKD), and the fundamental role of caregivers. For everyone, this is an extremely rewarding activity.

Key words : telemedicine, dialysis, overseas french territories

INTRODUCTION

Saint Pierre and Miquelon Islands (SPM) is a French Territorial Collectivity located in the south of Newfoundland 4500 km from the Metropolis without a permanent direct air link. In April 2012, the nephrology team at the Centre Hospitalier de St Brieuc launched a telemedicine connection with the Centre Hospitalier François Dunan (CHFD) until the opening of the new hospital structure in SPM at another site in September 2013. The transfer was made on a weekend corresponding to the moving of the entire Hospital Center. Beforehand, contacts between our two teams allowed us to gather their pioneering experience and the encountered difficulties. Since then, our ECHO establishment has been monitoring hemodialysis sessions by telemedicine by ensuring a semi-annual nephrological on-site mission and providing medico-technical responses if necessary.

Computer connection and its evolution (F. Denis, DSI ECHO; J. Letournel, DSI CHFD)

Initially (September 2013–September 2018), the IT architecture was built in response to the telemedicine decree (1) in the form of remote medical monitoring of hemodialysis sessions. An external operator was providing the video surveillance connection, guaranteeing security, encryption and the quality of the connection via a transatlantic cable (hourly cost 70 euros). Suddenly, while this company was absorbed by a Chinese consortium, it stopped the telemedicine activity in the middle of summer 2018 with one month's notice! Since then and in a semi-emergency), it has been easier to integrate the CHFD directly into the virtual private network (VPN) of ECHO, which was built in 2010 on Gigalis broadband infrastructures in the region "Pays de la Loire". Thus, nine ECHO medical dialysis unit (UDM) sites are linked to an ambulatory center by optical fiber or, to a lesser extent, by a high-speed subscriber line (of the order of 2 Mbit/s) independent of the SDSL (symmetric digital subscriber line) telephone network. The overall cost of this modification made in September 2018 with the CHFD was reduced by two-thirds. Since then, the two channels (videoconference and technical parameters) use the Internet via two separate tunnels (Figure 1).

The videoconference connection is activated in a few seconds by switching on the screens on both sides and the pre-recorded call from the remote control. At the same time, the technical data of the generators are downloaded by transfer software (without an interconnection box and whatever the type of generator) and are real-time integrated into the computerized patient records (MEDIAL) of our establishment, whom ECHO is the editor. As soon as the patients are connected, a secondary screen makes it possible to visualize these data instantly, which we have chosen to represent in the form of the "dialysis sheet" used by all generations of nephrologists since the 1970s. A line is incremented automatically every 10 minutes, and an additional line is displayed if a generator alarm is triggered (Figure 2). All data are recorded in real time in the patient file without any medical or nursing intervention (a computer station connected to MEDIAL has been installed in the UDM room of the CHFD). The history and traceability of all events are therefore fully preserved. Within these six years, there has never been a connection failure. In an emergency, a direct and dedicated telephone line was also established from the beginning.

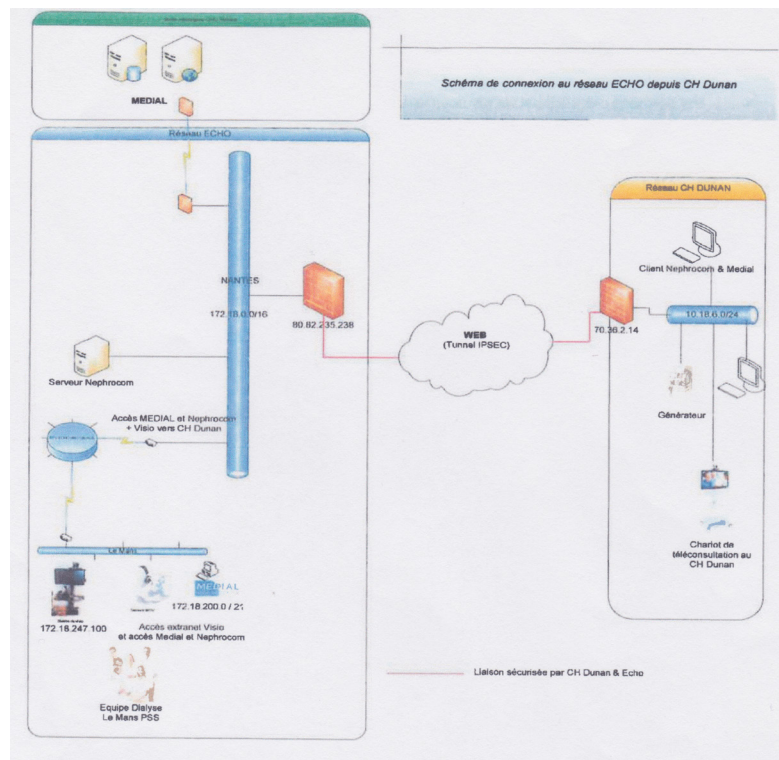


Figure 1: IT architecture of the ECHO-CHFD link since September 2017

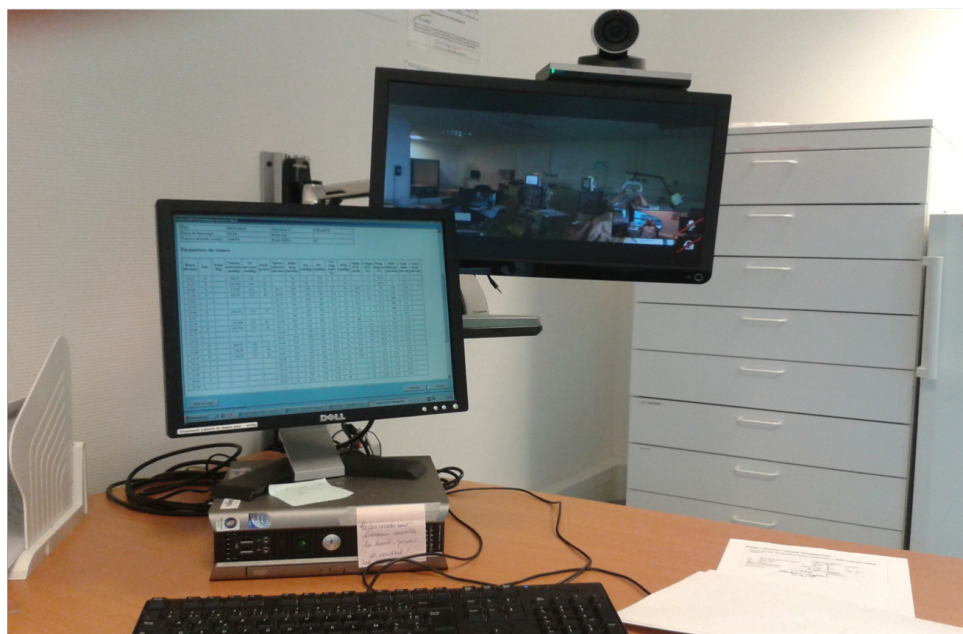


Figure 2: Teletransmitted hemodialysis session parameters

Equipment and technical monitoring: Dialysis generators, water treatment

The hemodialysis water treatment plant was included in the tender for the construction of the new CHFD, and the professionals concerned were therefore not consulted. It is a simple classic system based on a pretreatment (successive decreasing filtration, softener, activated carbon in

an undersized casing), then a simple osmosis system that does not allow convective treatment in hemodiafiltration. Over the years, significant improvements have been made with the installation of a colloid filter upstream of the pretreatment, which has definitively settled the question of the constant clogging of conventional filters downstream. A heat exchanger had to be installed secondarily because the general arrival of water at CHF D goes through the boiler room, and the temperature of the raw water was regularly between 25° and 30° before the pretreatment, though the climate of SPM is far from tropical! Regular disinfection with peracetic acid is carried out by biomedical technicians.

An emergency water treatment system (Aqua-Uno, Fresenius*) is located in the dialysis room; it can be used for a single generator. It is maintained and used regularly so as not to lose its use when it becomes necessary.

Quality control : analyses

Quality control of the entire processing chain has been the subject of publication (2). The isolation of the Archipelago poses specific problems that are difficult to imagine in Metropolitan France. Microbiological controls are sent to Metropolitan France by the unique weekly semi-direct air link via Montreal. The samples must be taken on Thursday afternoon to be entrusted to the forwarder who prepares the shipment by the two successive flights on Saturday. The cold chain is not completely respected, and the samples can only arrive at the destination laboratory in the best of cases on the following Monday or Tuesday.

Taking this problem into account, a recent and innovative technique was introduced in 2013 for the detection of microorganisms, ATPmetry (Gambro, then GLBiocontrol since 2016). A complete ATPmetry kit was brought into demonstration and then acquired by the CHF D in September 2013. Its simplicity of use and almost immediate rendering of results led us to practice priming and restitution online (3).

Despite and due to the very low dialysis activity, great vigilance is dedicated to the qualitative monitoring of the water produced. Recently, an abnormal finding of aluminum in the water in the loop in the laboratory of the DTAM (Directorate of Food and Sea Territories) triggered an alert and a remote discussion between the different operators and managers. The precise analysis of the situation pending controls carried out in Metropolitan France prompted the decision to continue the sessions within 24 hours without considering the Medical Evacuation (EVASAN) of the patients treated.

Monitoring MRC and dialysis patients

Here more than elsewhere, discovering a patient with end-stage renal disease is a major public health problem. In theory, everything dealing with the treatment can be anticipated.

A one-week nephrology mission carried out every six months was initiated by Prof. Hubert Nivet (CHU Tours) in the early 2000s and is currently carried out by one of us on a work-study basis. These are outpatient consultations with patients followed and known to or referred by one of the island's general practitioners. Tuesday is reserved for patients who come from Miquelon by boat and leave in the evening. A few weeks before the mission, the biologist from the CHF D

(which has a single medical biology laboratory) communicates the list of creatinine greater than 200 $\mu\text{mol/L}$ and GFRs below 30 mL/min. Patients not known to us are systematically summoned to a nephrological consultation during our visit. One of the major roles of the dialysis nurse is to prepare this nephrological consultation mission. Given the small number of inhabitants (around 6,000, including 600 in Miquelon), there has been a single file, which has been completely dematerialized since the year following the opening of the new CHFD. For specific situations (urological surgery, need for PBR), medical evacuation (EVASAN) can be organized in conjunction with the EVASAN Commission (weekly) and the medical adviser of the Caisse de Protection Sociale (CPS, specific health insurance in SPM). A patient followed for years for an idiopathic nephrotic syndrome balanced by mycophenolate after multiple relapses benefited in day hospitalization during a six-month nephrological mission to CHFD from an infusion of Rituximab (planned during the previous mission), which allowed them thereafter to decrease, then stop any specific treatment.

Access to transplantation poses difficult problems. None of the dialysis patients have currently accepted a pre-transplant registration or assessment, as this requires leaving the Archipelago for a long period of time and in any case is completely unpredictable. Only one transplant patient (from Montreal) is currently being followed up, with a follow-up of more than 30 years!

The role of teledialysis nurses

The nurses recruited by the CHFD to ensure dialysis all have original and rich professional and personal biographies: most have stayed in one or more French Overseas Departments or Territories (Antilles, Guyana, Réunion, Caledonia, Polynesia) with specific conditions of practice: remoteness and isolation, but most often the presence of a nephrologist on site or who can intervene within a short time.

The distance monitoring by the remote nephrologist consists of monitoring clinical (with the help of the teledialysis nurse) and biological indicators and making himself available at each hemodialysis session. The monthly teleconsultation with the UDM patient is carried out by videoconference with an on-site “correspondent” doctor, who is generally the emergency doctor (these are located next to the dialysis room) or a doctor from the emergency department, who carries out the medical examination on the spot. In reality, the availability and rapid turnover of contractual practitioners on the spot does not always make it possible to meet the recommendations of the High Authority for Health (4). However, in the event of a significant medical problem in one of the patients, a CHFD practitioner makes himself immediately available and contacts one of us. It is therefore the teledialysis nurse who fulfills this role by being able to detect unusual clinical signs, question a periodic biological result, or alert about a skin or approach problem. A remote camera is very useful for examining a visible clinical anomaly (FAV) from a distance. This can be supplemented by photos taken by the nurse and transmitted in real time. A difficult problem of a false channel during a puncture then infection of a first approach (button-hole) could be diagnosed and treated without delay and without the need for a transfer to Newfoundland (English-speaking Canada) at the end of 2019. Nurses have critical competence for monitoring generators and autonomous water treatment. An inter-establishment agreement provides for an annual stay of two weeks for the patient in our Center to benefit from the various updates. Finally, locally treatment patients have high requirements, and it takes a great deal of psychological maturity to deal with it.

The regulatory obligations of monitoring patients in telesurveillance UDM, and in particular the availability on the spot of the nephrologist, could be delegated to such professionals who in reality have a professional profile of advanced practices.

CONCLUSIONS : A rich experience in nephrology

The two characteristics of the teledialysis installed in Saint Pierre and Miquelon are the isolation of the Archipelago and the very low activity, which does not allow patients to acquire sufficient expertise to consider greater autonomy. Other French overseas territories have reported their experience in very different social and geographic conditions (5). The geographical particularity of SPM does not make it possible to completely comply with French regulations, but the differences that exist are minimal and accepted by all of the players (doctors, pharmacists, technicians, directors). A half-yearly analysis of the entire MRC course is made at the end of each mission (in particular, of for (?) the few incident patients who are arriving on renal replacement therapy).

For the nephrologist who remotely takes responsibility for the patients in care, this is an ongoing challenge. This requires a lot of availability but forces us to imagine emergency situations or degraded procedures in the event of a possible problem whose medical, human, and economic consequences are far from negligible. And this creates a very strong bond between all the medical, healthcare, technical, IT, and administrative players based on mutual trust. Ultimately, the telemedicine applied to dialysis which we have experienced is by no means a virtual and abstract medicine. It remains essentially and deeply clinical, the tools developed above (unimaginable 10 years ago) being only in the service of nephrological medicine between actors who are very professionally united and with years amicably.

Ultimately, the isolation, the very specific nursing role, and the problems encountered bring this activity in the PMS Archipelago very close to home dialysis. This requires great availability (not always easy with a time difference: TU-3) and experienced caregivers who are not afraid of unexpected event. No doubt this is destined for a rapidly expanding future (6)! If we take a step back (7), it is the technological evolution of the means of communication that has made it possible to imagine these advances to which the practitioner and the caregiver must adapt to be of service to our patients (8).

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Conflicts of interest : none

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