

Le Bulletin de la Dialyse à Domicile

HISTORY OF PERITONEAL DIALYSIS IN FRANCE

(Histoire de la dialyse péritonéale en France)

Note : this is a bi-lingual publication (translated from the original French text available at : <https://doi.org/10.25796/bdd.v2i3.22103>)

Christian Verger¹, Jacques Chanliou²

¹RDPLF, 30 rue Séré Depoin, 95340 Pontoise, France

²ALTIR, Vandoeuvre les Nancy Cedex, France

Résumé

En France les premières dialyses péritonéales ont été réalisées au milieu des années 40. Pendant longtemps réservée à des sujets fragiles chez lesquels l'hémodialyse paraissait plus dangereuse, elle est considérée de nos jours comme une technique équivalente à l'hémodialyse, pourvu que ses indications et contre-indications soient respectées et associé au respect du libre choix du patients après information objective. Il existe un consensus en particulier pour reconnaître son intérêt en attente de transplantation. Au cours des décennies passées les équipes françaises ont joué leur rôle au niveau national et international, très souvent en partenariat avec leurs voisins européens, pour améliorer les résultats obtenus et faire progresser la technique. La possibilité d'évaluation a été, dès la fin des années 80, possible grâce à la participation à un registre spécialisé. Cet article fait une revue générale, non exhaustive, du rôle joué par les principales équipes Françaises qui se sont succédées.

Mots clés : dialyse péritonéale, histoire

Summary

In France the first peritoneal dialysis was performed in the mid-1940s. For a long time reserved for frail subjects in whom hemodialysis appeared more dangerous, it is considered nowadays as a technique equivalent to hemodialysis, provided its indications and contraindications are respected and associated with the respect of the patient's free choice after objective information. In particular, there is now a consensus to recognize its interest in patients waiting for transplantation, usually in order to preserve vascular access. Over the past decades French teams have played their role nationally and internationally, very often in partnership with their European neighbors, to improve the results achieved and to improve the different modalities. Since the end of the 1980s, the evaluation of practices has been made possible thanks to the participation in a specialized peritoneal dialysis registry. This article is a general review, not exhaustive, of the role played by the main French teams who succeeded one another.

Keywords : peritoneal dialyse, history

HISTORY OF PERITONEAL DIALYSIS (PD) IN FRANCE

It would not be fair, even if the subject of this article is “French History of Peritoneal dialysis”, to write it without a word about all those not in France who were the key persons of the development of PD. In 1877, the German G. Wegner (1) first demonstrated with animals the ability of removing water using sugar solution in the peritoneum. Peritoneal dialysis began in 1923 in Germany with the first works of George Ganter (2) ; he demonstrated that the single or repeated instillation of physiological NaCl solution in the peritoneum improved the clinical symptoms of uremia and blood urea nitrogen in experimental nephritic guinea pigs and rabbits. Then many physicians abroad made it usable in humans. Without having the possibility of mentioning all these brilliant scientists, we may quote particularly : Henry Tenckhoff (3) who invented the silicone double cuff catheter for chronic peritoneal dialysis patients, still extensively used today with only slight modifications. Jack Moncrief and Robert Popovich (4) started the modern treatment with CAPD, followed in Canada by Dimitrios Oreopoulos (5) who first used plastic bags. Then Karl Nolph promoted CAPD in the US and published many works on physiology. A modification of CAPD, transformed from a daily manual to a nightly automated method was launched in 1981 by Diaz Buxo (6) with CCPD.

In Europe, many nephrologists participated in achieving better knowledge and improvement of PD : an unlimited list includes Bengt Rippe and Bengt Lindholm (Sweden), Raymond Krediet, Dirk Struijk (The Netherlands), Ram Gokal, Simon Davies, Nick Topley, Edwina Brown... (United Kingdom), Rafael Selgas (Spain), Anabella Rodriguez (Portugal), James Heaf (Denmark), Giorgio Bazatto, Umberto Buonchristiani (Italy where Y line and then double bag systems were invented)), Max Dratwa, Norbert Lameire, Wim van Biesen, Eric Goffin, Johan Morelle, Olivier Devuyst (Belgium) ..etc..

In France, the first attempt of treating acute renal failure by peritoneal dialysis was made by Maurice Derot in collaboration with Pierre Tanret and Charles Reymond (7) in 1946 at the Paris Hotel Dieu Hospital. Peritoneal dialysis was used for acute renal failure only and many papers were published by the team of Derot during the following years. The debate is still ongoing about the advantages of peritoneal dialysis versus hemodialysis (HD), as was previously discussed by Derot (8)

Charles Mion began iterative peritoneal dialysis with a cyclor and repeated peritoneal punctures in the United States with Fred Boen in 1964 (9). In France, he was joined by Alain Slingeneyer in 1974. Slingeneyer replaced the iterative punctures by using the permanent silicone Tenckhoff catheter and participated in designing a new cyclor (called Capucine) which used 10 L dialysate cans. This innovative technique allowed the possibility to dialyze older and frail patients at home who were otherwise considered unsuitable for HD.



Alain Slingeneyer (1947-2014)
<http://www.sfnfdt.org/sn/enephro/histoire/inmemoriam/slingeneyer.htm>

Before 1979 intermittent peritoneal dialysis was only used for high risk patients ; the treatment consisted in 12 hour sessions three times a week using 40 litres of dialysate per session.

Due to poorly protected connexions between containers and tubings, the rate of peritoneal infection was high, around 1 episode every 3 to 6 months. In addition this intermittent technique was not very efficient in terms of dialysis adequacy.

Considered as a revolutionary technique invented by Popovich and Moncrief in Austin, Texas (4), Continuous Ambulatory Peritoneal Dialysis (CAPD) was soon used by A. Slingeneyer who developed an on-line filter to try to prevent peritonitis (11). However this filter was used only in Montpellier, hardly being accepted by patients in other centres due to its inconvenient volume and some technical problems. Following Slingeneyer, it is at the end of 1979 that CAPD was pioneered in France by several teams : Bernadette Faller in Colmar when she returned from training with Oreopoulos at Toronto Western hospital (12,13), Jacques Rottembourg who focused his works on intraperitoneal insulin therapy for diabetics (14), Christian Verger in Pontoise. A multicenter study gathering the experience of the main teams involved in CAPD was published (in French) in 1985 (15).

Due to the high risk of peritonitis in the early 80s, most transplantation teams were reluctant to transplant PD patients. However first successful results in France were soon published demonstrating that there was not a higher risk of post operative infections in these patients (16), and currently on CAPD as well as APD are widely considered as treatment of choice for patients awaiting for a kidney transplant.

In additions to the above references, from 1980 up to now numerous works were published by the French teams which contributed to both an improvement of the understanding of peritoneal dialysis physiology, its complications and its improvement :

- improvement in infectious risk : the Achilles' heel of peritoneal dialysis in the 80s was the high frequency of peritonitis which was about 1 episode every 6 months. Following the success of Giorgio Bazzato who had designed a double bag system in Italy (17), not available in France, we designed a reusable Y set with two lines which were filled with polyvidone iodine between two exchanges. With this system, once the connection was performed the next step was to drain the peritoneum which allowed to eliminate any bacterial contamination during the connection procedure. This system allowed to decrease the rate of peritonitis down to 12 months (18). The next step was to demonstrate that with a pre connected double bag and Y system no in line disinfection was necessary (19) and the term "Flush before fill" (20) was first used to describe this method which now allows a peritonitis rate as low as 1 episode every 35 to 40 months in France.

Albeit it was later described that ultrafiltration is mainly in relation with capillary wall (mostly the aquaporins), early works proved that the integrity of the peritoneal membrane play a role in permeability as loss of ultrafiltration due to hyperpermeability to glucose was anatomically associated with mesothelial denudation (21,22,23). Two types of ultrafiltration loss were then described, one due to hyperpermeability, the other due to severe hypo permeability mainly in relation with multiple adhesions and or encapsulating peritonitis (24,25). Encapsulating peritonitis was initially described in France, probably due to the fact that access to the operating theatre by medical doctors was more frequent than in other countries. A large multicenter report was presented on the subject by Alain Slingeneyer (26) and the role of acetate buffer in the solutions used in France was identified as a high risk factor (27) justifying later on the exclusive use of Lactate. More biocompatible solutions were later designed by international manufacturers and are now extensively used.

The changes in peritoneal permeability, described by the variations of urea, creatinine and glucose transport were proposed to follow these patients and prevent complications. Whereas in the US, Twardowsky was describing the PET test, we adapted the crossing point described by Michel Fischbach (28) in infants to use it in the adults the term of APEX (29).

The use of PD in children has been the professional life accomplishment of Michel Fischbach (Strasbourg) and the number of his international publications in this domain are so extensive that it is impossible to report all of them here : they deal with survival, quality of life, physiology, peritoneal transport, role of aquaporins, etc ..his most recent researches have been on a new concept, called "adapted" peritoneal dialysis. This method first uses a short dwell time with a small fill volume to promote ultrafiltration (UF) and subsequently uses a longer dwell time and a larger fill volume to promote removal of uremic toxins from the blood. This improves the efficiency of osmotic ultrafiltration with lower glucose absorption and less sodium sieving (30).

In 1997, in order to limit malnutrition while maintaining sufficient ultrafiltration, Bernadette Faller (Colmar) successfully experimented a mixture of amino acids and polyglucose (31).

In the same concept of using a mixture of solutes, Philippe Freida followed the preliminary works of Elisabeth Peers (32) and of the Sheffield's team (33) by clinically experimenting in a multicentric study a so-called "bimodal" solution with a mixture of icodextrin and hypertonic glucose (34).

Unfortunately, no manufacturer has finally marketed these solutions.

In the Hopital Pitie Salpêtrière in Paris, historically with Marcel Legrain, then Claude Jacobs, Jacques Rottembourg, and during the last 20 years with Belkacem Issad, numerous papers were published, increasing the knowledge of peritoneal dialysis and the role of nursing staff has been underlined. (35,36,37). Belkacem Issad was a faithful participant of the Symposium that he never missed and to which he has always contributed.

Many other new ideas found their source in the French pioneers of modern peritoneal dialysis and these pages of French PD history would not be complete without the role of the nephrologists of Nancy (Michèle Kessler, Jacques Chanliau, Pierre Yves Durand). Among the new ideas brought to the peritoneal dialysis community by this team, two were particularly innovative: the measurement of intraperitoneal pressure (38,39,40) and determination of the moment when dialysate flow rate decreases sharply during the drainage phase (Breakpoint). A few years later, the same team described the use of this "Breakpoint" which determines the moment when the flow of drainage decreases abruptly, which made it possible to optimize the dialysis sessions

(40).

It was in France where the measurement of intra-abdominal pressure in peritoneal dialysis was described with its technique, its standards and its implications in clinical practice. It is nowadays an unavoidable reference (41) for monitoring patients on peritoneal dialysis.

Among the activities and initiatives which contributed to the fame of peritoneal dialysis in France are the results of transplantation by the nephrology team of Caen university (42,43) : they rapidly demonstrated that there was no increased risk of peritonitis when patients are transplanted, whereas numerous transplantation team around the world were afraid of doing it.

Another historical characteristic of peritoneal dialysis in France has been the practice of assisted PD. For a long time, France has been the only country to maintain at home older and frail dependent PD patients. This is due to the fact that about 55.000 private nurses paid by the national social security are authorized to assist non autonomous patients at home in their bag exchanges on CAPD or for their connections and disconnections on APD. So about 45 % of the French patients are assisted at home. (44, 45, 46, 47) Now most European countries use what is called assisted peritoneal dialysis in order to maintain at home frail patients who need nurse assistance.

During the past recent years, French PD also has been contemporary of the development of telemedicine for dialysis : the Diatelic system and its expert system developed with Jacques Chanliau at the ALTIR association in Nancy (48,49), the application used by Agnès Caillette in the Caly dial association (50) and the action of Pierre Simon playing a leading role in its recognition by the supervisory authorities (51).

New indications of peritoneal dialysis are the topic of studies in France to evaluate its usefulness in NYHA type V cardiac failure. It seems at least to decrease hospitalization rate and improve quality of life (52,53,54). Influence on survival in this group of patients remains unknown and controversial.

No medical progress is possible without the support of the industry: telling the history of peritoneal dialysis in France it is also to recognize the help that some managers of companies of artificial organs brought. Beyond the commercial relationship, their human qualities and the relations they have established, in a scrupulous respect for ethics, have very often made it possible to innovate in a relationship of trust at the service of the patients:

without them, much progress in the management of peritoneal dialysis would not have seen the light of day. Quoting all the names would be difficult in the context of this article, but we will retain the role of Michel Darnaud who was one of the main drivers of the development of peritoneal dialysis in France and has always provided unwavering support to the RDPLF for over thirty years while his career has continued in areas far from dialysis (<https://www.magazine-decideurs.com/news/michel-darnaud-rejoint-strammer>).

Last but not least, has been the availability of an international French speaking registry specialized in the follow up of PD patients in French speaking countries (France, Belgium, Switzerland, Tunisia, Morocco) : it has been launched by its present president, Christian Verger, in collaboration with Jean Philippe Ryckelynck, in 1986 under the name RDPLF, for “Registre de Dialyse Péritonéale de Langue Française” (French Language Peritoneal Dialysis Registry) (55). Annual Results and publications are available on its site <http://www.rdplf.org>. It gathers data from more than 42.000 PD patients included since its launch in 1986. Available to both physicians and nurses it is used both for training, coaching of new nephrologists and nurses, PD epidemiological studies. It is the largest registry devoted to PD in Europe. It is organized in different modules which include survival, comorbidity, infection, transplantation, PD catheters, anemia, dialysis adequacy and nutrition, and cardiac failure. For the last recent years it has become a general home dialysis registry as it gathers both home PD and home HD patients.

However, even with this impressive involvement of the previously quoted nephrologists during all these years, and the encouragements of some nephrologists in universities, among them Françoise Mignon at Hôpital Tenon in Paris (56), peritoneal dialysis remains underused in France with only an average of 8 % of all dialysis patients. Causes are complex and multiple : rate of reimbursement of institutions as well as of nephrologists, lack of training in the university courses, early bad results which discouraged young nephrologists in the 80s, lack of trained personnel, lack of surgical skill in catheter implantation (57) etc..are among the causes of this underutilization of the method, whereas the High Authority of Health has published very few contraindications (58).

With the recent development of new HD machines we have observed an increased number of patients starting home HD. Both techniques appear complementary as they do not concern the same patients. In addition, if

we can consider that PD is probably the best indication for patients waiting for kidney transplant, for those not transplanted, home HD with the new machines could be the solution for maintaining PD patients at home when the peritoneal dialysis is not anymore possible : in the RDPLF, 14 % of home HD patients have been previously on PD, with a transitional period of transplantation or in centre HD.

The French government has set up financial incentive decisions, both for nephrologists, private nurses assisting nursing home patients, and institutions. Training in the universities has been developed, a peritoneal dialysis university degree has been created with internet courses. A new generation of better trained nephrologists is arriving, with high level scientists studying the peritoneal membrane at a molecular level. Patients' testimonies (<http://www.rdplf.org/information-patients/temoignages-patients.html>) help convince health professionals. New more biocompatible solutions are available. So there is great hope that French nephrologists will continue to write their part of PD history in the future for the profit and safety of their patients. Concrete proposals, by nephrologists and the Francophone Society of Nephrology, Dialysis and Transplantation are published (59) ; it is the will and determination of our politics which will allow the history of home dialysis in France to continue.

CONFLITS D'INTERET

Les auteurs déclarent ne pas avoir de conflit d'intérêt pour cet article.

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Bulletin de la Dialyse à Domicile Vol. 1 No 2 (2018)
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Reçu le 07/06/18, accepté après révision le 20/08/19, publié le 20/09/19

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