



## Transplantation and Dialysis: Recording of Transplanted Patients Who Re-Enter in Their Hemodialysis or Peritoneal Dialysis Hospitalization Units

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### Abstract

**Objective:** In the present study, we evaluated the rate of discharges of patients who had been enrolled in a type of dialysis and had re-engaged by measuring other factors, during the years 2013-2015.

**Methods:** We recorded the characteristics of 2.586 HD and 100 PD patients who, in some point of their life, been transplanted and needed to re-entry their hospitalization units. We compared these data with others retrieved from researches across countries of both inside and outside the European Union.

**Results:** The mean patient age of our specimen was  $68.7 \pm 14.1$  years, with the percentage of female gender at 36.3% (938), while the remaining 63.7% (1.648) are men. Most common ESRD cause was diabetes (32% for PD and 24% for HD patients). Employed PD patients were 35% vs. 4% of HD ( $p < 0.001$ ), with almost 61% (1.005) of men not smokers, while the women have a similar 79.1%.

**Conclusion:** Although Greece has one of the smallest graft rejection rates, it does not cease to have the smallest rates of transplantation both in the rest of Europe and beyond.

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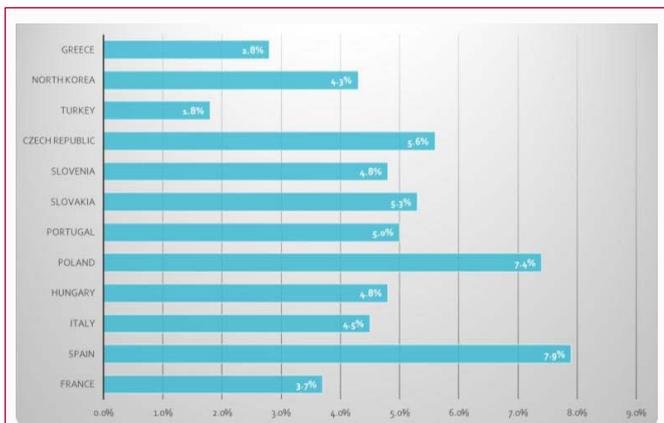
**Keywords:** Hemodialysis; Peritoneal dialysis; Transplantation

### Introduction

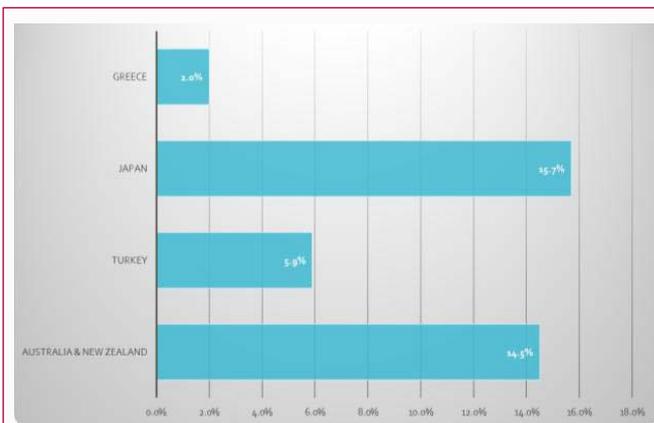
Kidney transplantation appears at 1902 when Ullman reported that he could cope uremia with kidney transplantation [1]. The first known attempts at clinical kidney transplantation, from experimental animals to humans by performing vascular anastomoses, are reported between the years 1906-1923. As transplants, kidney derived from pigs and goats from Jaboulay in 1906 [2], monkeys from the Unger in 1910 [3] and Schonstadt in 1913 [4], and from sheep by Neuhof in 1923 [5]. Of course, none of these cuttings worked and the patients died a few hours or up to nine days after transplantation. In 1933, based on Carrel's method, Mann and his colleagues transplanted into an experimental heart maintained in normal heart rate for eight days [6].

The first human-to-human kidney transplant was conducted by Voronoi in 1936 [7]. This researcher transplanted kidney from cadaveric donor with blood group B (Rh +) to group C (Rh +) recipient. After 48 hrs, the recipient died and the death attributed to the incompatibility of the blood groups. In the year 1948, Hufnagel, Hume and Landsteiner announced the kidney transplantation from a man who had just died in a woman who was comatose from acute tubular necrosis. Although the transplanted kidney ceased to function after three days, it was given the opportunity to the patient to recover from the coma and survive [8].

In March 1951, Springfield Hospital, Massachusetts, became the first orthotopic kidney transplant from Scola [9]. This surgeon shaken the kidney with the spleen vessels. At the same time, many attempts at clinical kidney transplantation were reported in the iliac seabed by surgeons from the French School, Professor Kuss [10], Professors Dubost et al. [11], and Servelle [12]. In the following years successive attempts were made for renal transplantation in the iliac septic, with anastomosis of the kidney with the iliac vasculature by Lawer, Hume, Michon, Murray, Joeques and Krieg [13-18]. These transplants were done without immuno suppression and most grafts were discarded within a few weeks, although most of the operational problems had been resolved.



**Figure 1:** Percentage of transplanted patients needed to be re-enter in their HD hospitalization units.



**Figure 2:** Percentage of transplanted patients needed to be re-enter in their PD hospitalization units.

Before proceeding below, it should be noted that first, since 1924, Professor of the University of Stanford, Calif., USA, Hollman had argued that the reaction of rejection is an unattended phenomenon [19]. Twenty years later, Professor Medawar proved that rejection of the implants is a reaction of immunity [20]. He same recurring researcher in the years 1944-1958, as well as Billingham and Brent, made the mechanism of rejection more understandable and pointed out the need to address this phenomenon [21]. While in 1953 the results of successful kidney transplantation with good kidney function [21] were reported, one year later, in 1954 Boston became the first kidney transplantation attempt between Murray’s single twin brothers [22].

Transplantation continues to be the treatment preferred by doctors for patients with end-stage renal disease as it is linked to improved quality of life, doubling the average survival of patients, and substantial economic benefits to the national health system. It is important to note that in all patients who transplanted and survived at a depth of 10 years, 33% of them received graft from living donor, while the remaining 67% from cadaveric one.

Before proceeding, it is important to mention that many of the surgical innovations successfully used in kidney transplantation were the result of borrowing from techniques used by vascular surgery and urology. According to the statistics, it is very likely that much of the innovation of the future will also take place in the field of transplant surgery. In addition, the issue of selecting candidates for transplantation in an aging population worries nephrologists in all Western countries. The choice of the ideal candidate recipient by the surgeon, since the graft is derived from a cadaveric donor, must ensure the best effect on transplantation and minimize the risk of rejection of the graft. However, this does not mean that some candidates for transplantation should be rejected, but that efforts to optimize their clinical picture should be prioritized and some factors such as obesity, such as failure to intervene or rejection of the transplant, may be reduced. An important recent innovation, now accepted by the scientific community, is the application of mechanical support and maintenance of the kidney. A method that enables the treating physician to achieve a better postoperative effect with optimistic prospects for survival of the graft [23]. Greece is one of the countries with a variety of geographical and social peculiarities, which has invested little in the substitution of renal disease with Peritoneal Cure over the past few years. According to the Greek Agency for Coordination and Control (CPC), the number of kidney

patients enrolled in a method of substitution for renal disease for the years 2013-2015 is about 12,628, of which only 668 use the Peritoneal Purification (PD). Of the remaining patients, a total of 2,563 have been transplanted, while 9,397 use the dialysis method (HD). From these data, the use of Peritoneal clearance accounts for about 5.3% of the population, which shows that although patients with end-stage renal disease in Greece are following the global upward trend, the number of those who are included in the method of Peritoneal Cleansing shows a decrease. However, to meet this need for use of Peritoneal Cleansing, there are currently 31 public hospitals across the country who are able to support patients undergoing this method, while the number of units (public and private) who support Hemodialysis is 158.

In Greece, only 14.25% of patients undergoing renal replacement therapy have undergone pre-transplantation control. Of these, 14% use the Artificial Kidney method and only 0.25% the Peritoneal Cure Method. Our study also recorded a rate of 2.8% which, while transplanting, due to rejection of the graft, had to be reintroduced into some of the methods of extra uterine dialysis. This percentage considered very important because the total proportion of transplanted patients is 20.3%, with 0.6% of them reporting to young patients, a figure quite low for European data. In the present study, we evaluated the rate of discharges of patients who had been enrolled in a type of dialysis and had re-engaged by measuring other factors during the years 2013-2015.

**Methods**

The data used for analysis based on the 2,586 and 100 patients who were included in the hemodialysis and peritoneal dialysis treatment respectively. These data concerned public hospitals and private clinics, and referring to a period of 2013-2015. In addition, analyzed patients data from different similar studies, involving countries form both inside and outside Europe.

Presented results appear as percentages and means with standard deviation. Comparison of basic parameters between the two groups performed by using the chi-square and student t-test of SPSS software for Windows version 22.0 (SPSS Inc., Chicago, IL, USA).

**Results**

We recorded 2,586 patients who integrated into the kidney disease substitution method with artificial kidney. Of these, 36.3% (938) refers to women with an average age of 69.4 ± 14.12 years whereas the

**Table 1:** Percentage of HD patients that have been transplanted (or not) in the past.

	Transplant and re-integration to HD			
	Years in HD			
	1-5	6-10	11-20	Over 20
<b>Patients never transplanted</b>	59,2%	28,5%	10,3%	2,0%
<b>Transplanted patients at have reject the graft</b>	21,9%	13,7%	34,2%	30,2%

**Table 2:** Percentage of PD patients that have been transplanted (or not) in the past.

Years in PD	Transplant			
	Yes		No	
	Pre-Transplant Control			
	Yes	No	Yes	No
1 - 5	1%	-	4%	68%
6 - 10	1%	-	1%	24%
11+	-	-	-	1%
Number of patients undergoing PD	2%	-	5%	93%

remaining 63.7% (1.648) are men of average age  $68.3 \pm 14.07$  years. From the record of the condition of the nephron paths that are our study sample, the sex ratio was found to be statistically significant at 95%, and whether it is a smoker, ex-ante or not, as shown in Figure 1 and 2 ( $\chi_2(2)=21,0$  and  $p<0.001$ ). More specifically, 60.98% (1.005) of men are non-smokers, while the female sex ratio is 79.10% (742).

Through the sample of the population undergoing peritoneal dialysis, we recorded 78.9% of all women aged 41 to 60 years of age (no smoking) (including a 5.3% former smoker), while 21.1% belonging to the same age group smokes. According the patient data retrieved for our sample, no smoker appears in the first two age groups - men and women - (0-18 years and 19 to 40 years) respectively, while in the fourth (over 61 years of age), regardless of sex, the majority of patients were either ex-smokers or no smokers, for a 95.2% for women and 69% for males.

Of the 2,586 patients in our sample, 21.9% of patients undergoing hemodialysis for a period of 1-5 years have been transplanted and recovered after renal implant loss, as shown in Table 1. At the same time, 1.5% of all patients in our dialysis sample undergoing dialysis derived from Peritoneal Cleansing, as shown in Table 2.

In the population sample recorded in the Peritoneal Purification Method, only 7% had pre-transplantation control, while only 2% had undergone transplantation, and due to rejection, it had to be reintroduced into the peritoneal hospitalization unit.

## Discussion

In 134 medical centers from 9 European countries (France, Spain, Italy, Hungary, Poland, Portugal, Slovakia, Slovenia, the Czech Republic) and Turkey, the recorded average age of the patients was  $63 \pm 14.9$  years, with a female percentage of 42.5% (24). This is analyzed taking into account that in France the average age is  $68.9 \pm 15$  years, when in Spain  $65.9 \pm 14.6$  and in Italy  $65.7 \pm 14$  years. At the same time, in Hungary the average is  $62.2 \pm 14.4$ , in Poland  $62.4 \pm 14.9$  and in Portugal  $64.5 \pm 15.2$  years. Also in Slovakia, the patients have an average age of  $58.1 \pm 13.6$ , in Slovenia  $64 \pm 12.2$  and in the Czech Republic  $66.3 \pm 13.2$  years. Finally, for Turkey, the average is the lowest of all countries and is  $56.4 \pm 14.5$  years. The gender balance for

the above countries shows that France has 41.2% women when Spain has 37.3% female patients, Italy 40.9%, Hungary 50.9%, Poland 42, 9%, Portugal 40.3%, Slovakia 40.4%, Slovenia 44.6% and the Czech Republic 50,6%. For Turkey, gender is 44.1% for women and 55.9% for men [24].

Similar research was also carried out in the countries of Switzerland, Taiwan, South Korea, Brazil, the Americas and China. As result, they measured  $55 \pm 16$ ,  $53.2 \pm 15.4$ ,  $58.1 \pm 14$ ,  $48.0 \pm 16.8$ ,  $60$ ,  $5 \pm 15.5$  and  $58.2 \pm 12.1$  years respectively, while the sex ratio for male patients recorded 60.5% (Switzerland), 40.6% (Taiwan), 60.3% (South Korea), 37.5% (Brazil), 47% (Americas) and 50.6% (China) [25-28]. The corresponding record in Greece from a sample of 2,586 patients, showed an average of  $68.7 \pm 14.1$  years, with 63.7% of them being men,

In a total of 134 medical centers in nine European countries (France, Spain, Italy, Hungary, Poland, Portugal, Slovakia, Slovenia, the Czech Republic) and Turkey it was observed that the total number of transplanted patients who had to reintegrate was 4.9% [24]. More specifically, France is 3.7%, Spain 7.9%, Italy 4.5%, Hungary 4.8%, Poland 7.4%, Portugal 5%, Portugal Slovakia 5,3%, Slovenia 4,8%, Czech Republic 5,6% and Turkey 1,8% [24]. Finally, the rates of transplanted patients who had to re-enter South Korea and Greece respectively are 4.3% and 2.8% respectively.

It was observed that in 2 patient samples (Australia & New Zealand, Japan), the proportion of transplanted patients reintroduced into a Peritoneal Dialysis program varied between 14.5% and 15.7% [29,30]. At the same time in Greece, this percentage is just 2% based on our study population.

In Portugal, data from a sample of 42 peritoneal patients were analyzed and their mean age was  $55.1 \pm 16.1$  years, with 52% of them being men. Analogically, in Turkey, the mean age was  $46.0 \pm 14.3$  years for 423 patients with 57.3% of them being male [31,32]. In Brazil, the average for 486 patients is  $58 \pm 15.1$  years, Japan (440) is  $60.2 \pm 7.3$  years, in South Korea (324)  $51.1 \pm 13.4$  years, in Taiwan 3136 patients had an average age of  $53.2 \pm 15.4$  years and in China the average for 5.405 subjects was  $52.2 \pm 15.2$  years [(178), (181), (41), (45), (46)]. The gender balance for the above countries shows that Brazil has 46% men when Japan has 62.3% male patients, South Korea 59.9%, Taiwan 40.6%, and China 39, 8%. Significantly, Greece has a proportional sample of 100 patients, an average age of  $64.5 \pm 16.8$  years, with 56% being male.

At the same time, by recording the primary cause of end-stage renal disease for individuals undergoing Peritoneal dialysis, we can say that for countries like Turkey (35.2%), Brazil (36%), Mexico (61% Korea (48.2%) and Australia & New Zealand (34.9%), diabetes is the leading cause of renal disease [30,32-35]. Gum glutamate is the cause of patients with Peritoneal dialysis in countries such as Portugal (31%) and Japan (70%), whereas in China, heart disease is the main cause of 41.5% [29,36,37]. Finally, for Greece, the primary disease of patients undergoing Peritoneal Cure, according to our study population, is diabetes with a percentage of 19.7% [38-45].

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