Elderly patients on dialysis: epidemiology of an epidemic

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Abstract. The increase in the incidence of elderly patients starting dialysis has been as sharp, during the 1980s–1990s, as an epidemic (+70%, +150% in different settings). According to this study, performed in Piemonte, northern Italy, the process is still ongoing. During the period 1981–93, according to the Regional Registry of Dialysis and Transplantation (RPDT: data on 100% of centres and patients), the cohort on treatment increased by 79.5% and the annual incidence by 48.3%; the increase is limited to older people and is greater in males. Nephroangiosclerosis/ischaemic renal disease and diabetes mellitus are the main diagnoses. Since the increase of elderly patients is still ongoing, forecasts are difficult; according to a computer simulation, a plateau of patients on treatment is reached only if incidence is stabilized. While it is impossible to exclude a decrease in hidden selection or an increase in referral, complex modifications at the overall population level are presumably at the basis or the increase of elderly patients on dialysis. Despite the increase in average age, however, survival improved throughout the period; this confirms the interest towards the open dialysis system adopted in Piemonte, which is characterized by easy shifts among treatments and by the widespread use of high tolerance techniques.

Key words: dialysis, elderly, epidemiology, incidence, registry, survival

Introduction

Speaking about the epidemiology of elderly patients on dialysis is becoming synonymous with describing a true epidemic; in fact the increase in patients aged >65 or 70 years has been, in most western European and northern American settings, the main cause of the 70–100% increase in the numbers new dialysis patients that was observed in the 1980s and early 1990s [1–7]. The definition of elderly patients has been changing over time. While in the 1970s, when acceptance for dialysis still depended on selective criteria, a patient was considered ‘old’ when aged >60 or even >55; currently interest has changed to the ‘old-old’, i.e. to patients >70 or 80 years of age [8–13].

The demographic metamorphosis presently occurring in the world of dialysis proceeds in the same direction—albeit more rapidly—as that of the overall population. In Italy, mean life expectancy (1990 data) is approaching 71 years for males and 79 years for females. This may, at least in part, explain the increase in the number of elderly patients starting dialysis but, as this study aims to investigate, several other factors may be involved, such as acceptance rates to treatment, referral to nephrologists, changes of prevalence and incidence of diseases leading to uraemia, and decrease in causes of death competing with, and somehow masking the incidence of, chronic renal disease. The study was performed in Piemonte, northern Italy, employing data from the Regional Registry of Dialysis and Transplantation (RPDT 1981–93), gathering information on 100% of the centres and on presumably 100% of the patients [1].

Materials and methods

Overall population

Piemonte, Northern Italy, ~4 430 000 inhabitants in 1981; ~4 300 000 inhabitants in 1993 [1].
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Dialysis system (December 1993 data)

Twenty-one dialysis centres (all public, also running 26 self-care facilities); one transplantation centre (373 grafts in 1990–1994). All centres perform at least four renal replacement treatments (in addition to bicarbonate dialysis, 18 perform CAPD and/or APD; all perform haemodiafiltration; and 15 undertake haemofiltration); 39.3% of patients are treated outside a hospital setting (3.5% at home, 16.4% on CAPD-APD, 19.4% in self-care dialysis units).

Data

Data have been obtained from the Regional Registry of Dialysis and Transplantation of Piemonte (RPDT), which since 1981 has gathered data on all the centres and on presumably on all chronic renal replacement therapy patients [1].


The data of the treatment cohort (RPDT, 1993) consisted of 6134 patients on file at the Registry; 4483 were accepted for dialysis in 1981–1993 (this includes all patients who started treatment in the region, excluding renal function recovery, with follow-up lasting ≥1 month). The number of patients on dialysis with functioning graft was 124 p.m.p.; the incidence of new grafts was 12 p.m.p. in 1981–1982, and 17.7 p.m.p. in 1991–1992 (regional centre and elsewhere).

Statistical analysis

The RPDT archives, updated by the CSI (Consorzio Sistema Informativo di Piemonte, cooperating with the Regional Health Council), were transferred to a PC and analysed using dBase IV, BMDP and SPSS software.

A provisional model designed to compare different hypotheses for the expansion of a regional dialysis pool was developed on Microsoft Excel 5.0 [A. Pacitti, personal communication]. In this kinetic model, the global dialysis pool was divided into two complementary sub-pools, of different ages (age <65 and >65 years); the cut-off point at 65 years was chosen since it marks, in our area, the limit between the 'transplantable' and 'not transplantable' pools. The younger pool is linked to the transplanted patient pool and to the older dialysis pool (ageing algorithm). The model calculates, year by year, the variations of each pool, on the basis of the following parameters: incidence of new patients (p.m.p.), survival on dialysis (%), transplant rate (p.m.p.) and graft survival (%) with eventual return to dialysis treatment (transplant drop-out).

Results

During the 13 years considered (1981–1993) the number of patients on treatment at the end of each year increased by 79.5% [1]; meanwhile the annual incidence of new patients accepted for dialysis grew from 70.8 p.m.p. (1981–1982) to 105 p.m.p. (1993; +48.3%) and the average age at start of dialysis increased from 54.9 ± 15.4 to 61.0 ± 14.0 years (P = 0.0000).

The analysis of new cases admitted for dialysis, sorted by gender and age, shows that the increase of new patients, still ongoing, is mainly due to a greater number of elderly patients, particularly males. The incidence of new male patients admitted for dialysis in Piemonte with aged ≥75 and ≥80 increased from 63.9 and 34.6 p.m.p. in 1981–1982 to 145.7 and 134.4 p.m.p. in 1993 [1].

Meanwhile, prevalence of high-risk conditions has been stable or slightly declining (all ages and both genders: from 50.4% in 1981–1982 to 47.8% in 1991–1992; age ≥65 years: from 79.6% in 1981–1982 to 62.2% in 1991–1992). As for the specific causes of ESRD, while the incidence of glomerulonephritis, pyelonephritis and polycystic kidney disease remained stable, a significant increase in diabetes mellitus and a striking increase in nephroangiosclerosis-ischaemic renal disease were recorded. As expected where vasculopathy plays a pivotal role, incidence was greater and the increase was steeper in males (Figures 1 and 2).

Since the increase of elderly patients is still ongoing, it is difficult to make forecasts. A computer simulation was performed to evaluate the long-term effect of the number and age distribution of new entries into the dialysis pool on the progressive increase in the average age (Table 1, Figure 3).

Figure 3 depicts the differences between two models of expansion of the dialytic pool—the first according with the 1981 data (hypothsis A: incidence of new patients aged A, 72%; >65, 28%), and the second with the 1993 data (hypothesis B: incidence of new cases aged A, 55%; 45%). In both cases the trend is toward stabilization: the younger pool is balanced by transplantation, and the older pool is balanced by

Table 1. Main parameters entered in a kinetic model, to compare two hypotheses with a different age distribution: hypothesis A reproduces the age distribution observed in 1981, hypothesis B the distribution recorded in 1993

<table>
<thead>
<tr>
<th>Kinetic parameters</th>
<th>Hypothesis A</th>
<th>Hypothesis B</th>
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<tbody>
<tr>
<td>New entries rate</td>
<td>100</td>
<td>100</td>
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<tr>
<td>Age &gt;65 years</td>
<td>72</td>
<td>55</td>
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<tr>
<td>Age &lt;65 years</td>
<td>28</td>
<td>45</td>
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<tr>
<td>Transplant rate</td>
<td>30</td>
<td>30</td>
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<td>Survival on dialysis</td>
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</tr>
<tr>
<td>Age &gt;64 years</td>
<td>92</td>
<td>92</td>
</tr>
<tr>
<td>Age &lt;65 years</td>
<td>80</td>
<td>80</td>
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<tr>
<td>Survival after</td>
<td></td>
<td></td>
</tr>
<tr>
<td>transplantation</td>
<td>97</td>
<td>97</td>
</tr>
<tr>
<td>Graft failure</td>
<td>8</td>
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</tbody>
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mortality. The model further stresses the influence of the ageing of the overall population (reflected by different rates of p.m.p.) in defining the level of the plateau and the moment when it is reached.

Despite the highly significant increase in the average age of new elderly patients (for patients aged ≥65 years: the average age at start of dialysis was 71.3 years in 1981–1985, 72.6 years in 1991–1993; \( P = 0.0017 \)), the regional multiple-choice dialysis system with easy shifts among treatment and with wide use of high-tolerance techniques yielded a significant improvement in survival. At age ≥65 years survival at 12 months increased from 70.7% in 1981–1985 to 82.7% in 1991–1993; survival at 24 months increased from 54.7% in 1981–1985 to 62.3% in 1991–1993. The trend is present also at age ≥75, though is non-significant because of the small size of this cohort (Figure 4).

**Discussion**

Since it is impossible to consider incidence of new dialysis patients as synonymous with incidence of ESRD, and because of the lack of information on uraemic patients not treated by dialysis, the incidence of new dialysis patients is the only available index on which analysis may be based. In our region, as elsewhere described, a sharp increase in elderly patients starting renal replacement therapy was observed throughout the 1980s and early 1990s [1–7].

From the theoretical point of view, four factors may be implied in such a case: acceptance to treatment, referral to nephrologist, incidence of diagnosis, modifications in epidemiology of diseases leading to uraemia in the overall population—this may be in turn related to changes in the demography of the population and/or to modifications in its mortality and morbidity rates [14,15].

Since in our region open criteria for acceptance to treatment have been used since the mid-1970s, it is unlikely that a decrease in hidden selection alone can account for changes of this magnitude (48.3% increase in new dialysis patients from 1981–1982 to 1993, 132.6% in patients aged >70). Moreover, if acceptance was the crucial point, then the widening of selection criteria should have led to an increase of very ill patients, i.e. old and at high risk. On the contrary, the prevalence of high-risk conditions in the elderly has been decreasing in this period (age ≥65 years: 79.6% in 1981–1982 to 62.2% in 1991–1992). This apparent paradox is probably linked to modifications that have been made to the definition of the 'standard' patient: in the 1970s the ‘usual’ patient was actually a relatively young one, most frequently with glomerular disease and without co-morbid factors, while at present we are often starting renal replacement therapy in subjects aged >60, with a diagnosis of nephroangiosclerosis-ischaemic renal disease, in many cases with diffuse peripheral vasculopathy as a co-morbid condition [16]. The habit of dealing with old atherosclerotic patients may actually lead to a somehow less strict definition of high risk, as has occurred in our region.

Another interesting question is raised by the growing incidence of diabetic patients accepted for dialysis (in males: from 7.4 p.m.p. [9.7%] in 1981–1982, to 20.5 p.m.p. [16.7%] in 1991–1992: see Figure 1): since incidence has been stable in the younger and has been increasing only in the elderly, it is possible to postulate that diabetes *per se* was not a discriminant, but that other factors are implied, such as increase in prevalence of diabetes in the overall ageing population or increase in lifespan of diabetic patients, due to the advances in therapy of this disease [17].

On the other hand, if an increase in referrals to nephrologists was the crucial point, then the pattern observed should be analogous to that discussed about acceptance, selectively involving elderly, high-risk patients, who are probably discriminated against also at the pre-nephrological level. Since this is not the case, an explanation of this complex event should most probably be searched for in the changes occurring in the overall population.

Even if the incidence of ESRD increases with age, the increase of new dialysis patients has not been directly proportional and, therefore, it is not merely explainable by the increase in elderly individuals (Figure 1).

In our context, a longer lifespan is not considered as due to a decrease in the biological age of the elderly, but is linked to a decrease in death rates, principally through cardiovascular impairment. Such a situation may lead to an increase in morbidity for diseases related to diffuse vascular diseases, which are still present but no longer deadly. In keeping with this hypothesis, the outstanding diagnosis of the late 1980s and early 1990s...
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Fig. 4.

has been (whatever this umbrella term means) nephroangiosclerosis-ischaemic renal disease (Figure 2). The increase in hypertensive atherosclerotic renal disease may also partly explain the increase in elderly diabetic patients, especially males—a cohort in which atherosclerosis is almost the rule, even in the absence of classical intensely proteinuric nephropathy [17].

Diabetic nephropathy and nephroangiosclerosis-ischaemic renal disease are reported to be also increasing in other contexts [18], but the apparent increase in these generic and often over-simple definitions begs a further set of questions, so far unanswered. Most registries tend to consider diabetic nephropathy as synonymous with nephropathy in diabetic patients, and a retrospective definition of the cause of ESRD may be impossible after dialysis has started. In keeping with the pivotal role of vascular impairment among the vast array of renal diseases in diabetic patients, in 111 of 659 cases started on dialysis in 1981–1993 (56 of 111 at age ≥65), where a non-diabetic cause of uraemia was recorded, nephroangiosclerosis was the most frequent diagnosis (50.4%). While this is still presumably an underestimate, it may focus attention on the need for a precise definition of renal impairment in this cohort.

Nephroangiosclerosis-ischaemic renal disease is likewise often a diagnosis made by exclusion, and is offered when hypertension or diffuse vascular disease are the only clinical or predisposing factors identified. The effect of silent glomerulonephritis or interstitial nephritis is difficult, if not impossible, to assess and cholesterol embolic disease is becoming another frequent prominent definition in this diagnostic group.

These complex changes are still ongoing and, while the dialysis system tends to stabilize over time (Figure 3), the most crucial determinant of where and at which level the plateau of patients on treatment is eventually reached is presently the acceptance rate of new dialysis patients.

Conclusion

Respect for the elderly and for the right to life is a key aspect of a number of ancient cultures. An overview of dialysis in our region shows that criteria for acceptance have been opened, and there have been deaths caused by interruption to treatment. These factors, together with the ageing of the overall population, have lead to a significant increase in the number of elderly patients on dialysis.

The epidemic of ESRD in the elderly was, in our and other settings, one of the most important problems faced by nephrologists. The increase recorded throughout the 1980s and early 1990s is still ongoing. While it is impossible to exclude a role of a decrease in hidden selections or of an increase in referral, complex modifications in the overall population of industrialized countries are probably at the basis of this phenomenon. Focusing on the characterization of causes of uraemia in the elderly has not only speculative purposes but is crucial for directing interventions towards prevention.
RPDT Working Group


References


