Global dialysis perspective: Israel
Renal Replacement Therapy Management and Funding in Israel

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Introduction

Preliminary efforts for urgent dialysis as a life-saving measure for acute kidney injury (AKI) were reported in 3 patients by Dr. Kurt Steinitz, in Haifa, Israel as early as in 1948. He built a crude dialysis machine based on the publications of Kolff and Alwell. Three patients were treated and only one survived\(^1\). An established dialysis program for AKI and end stage renal disease (ESRD) with trained staff began in 1958 and 1965, respectively, at the Hadassah university hospital in Jerusalem under the direction of Prof. Ulman who had trained in the US. After the successful Hadassah experience, HD treatment soon spread to other main hospitals in the country. The first kidney transplantation in Israel was performed in Beilinson (today Rabin) medical center in 1964, by Prof. Morris Levy from a mother to her son, only ten years after the first successful kidney transplantation in the world between twin brothers in Boston.

Methods

Data was collected from the Israeli RRT Registry\(^2\), annual Israeli RRT Registry reports to the European Renal Association-European Dialysis Transplantation Association (ERA-EDTA)\(^3\) and United States Renal Data System (USRDS)\(^4\), Israeli ministry of Health (MOH) official publications\(^5\), and personal communications with Israeli opinion leaders in the field of Nephrology. Data for patients on dialysis for more than 90 days was collected using questioners delivered to heads of all Nephrology and dialysis units in the country that include age, sex, type of dialysis, community vs. hospital location, vascular access, primary renal disease, kidney transplantation and mortality. While every effort was carried out to verify the data presented here, this report is not an official document of Israeli authorities but reflects the knowledge and opinions of its authors.

Epidemiology

The incidence rate of dialysis in Israel is 179 per million population (pmp), while in 2015 it was 191 pmp, compared to the European average incidence of 121 pmp reported by the ERA-EDTA\(^3\). Median age of prevalent dialysis patients is 68, and 60% of incident RRT patients are men. Of note, the percentage of incident RRT patients with diabetes mellitus (DM) in Israel is one of the highest in the world, e.g. 50% (95 pmp\(^4\) in 2015) and the rate of prevalent Israeli dialysis patients with DM is the highest in the ERA-EDTA (355 pmp)\(^2\).

Another characteristic of RRT in Israel is the high number of incident patients older than 75, i.e. 1219 pmp, second only to the US (1360 pmp) and Taiwan\(^4\).

Prevalence of 75-84 yr-old patients on dialysis rose 4.8-fold between 1990 to 2015 and currently this is the most frequent age group on dialysis in Israel, comprising 4871 pmp, the highest rate in the ERA-EDTA. The prevalence of all types of RRT is 1199 pmp.
(62% dialysis, 38% transplants) compared to 823 pmp reported as average by the ERA-EDTA and 2,096 in the USA\(^3,4\). The prevalence of dialysis in Israel was 742 pmp in 2018 (768 pmp in 2015)\(^3\), compared to dialysis prevalence of 1,582 in the USA. The number of ESRD on the waiting list for kidney transplantation in Israel is 90 pmp (293 pmp in the US) and the transplantation rate in Israel in 2018 was 43 (45 pmp in 2015)\(^2\), compared to 32 pmp European average reported by the ERA-EDTA\(^2\) and 62 pmp in the US\(^3\). Five percent of incident RRT are pre-emptive transplantations.

Survival

In the last 5 years the average annual increase in the number of prevalent dialysis patients was 1.95%\(^2\), accounted for by the slightly improved survival. During 20 years of dialysis practice the survival of dialysis patients improved significantly in Israel (from 2010-2014 vs 1990-1994, HR 0.58)\(^2\). The annual mortality rate in Israeli dialysis patients is currently 18.5%\(^1\) compared to the average EDTA reported mortality rate of 17.2%\(^3\). For dialysis patients on the waiting list for transplantation the annual mortality is 5.7%\(^5\). Despite this low mortality rate relative to other dialysis patients, most of the patients on the waiting list will die while waiting for transplantation because slightly more (46 pmp in 2018) ESRD patients are joining the waiting list every year than are transplanted (43 pmp in 2018).

For female dialysis patients survival rates are better (HR 1.07 for males), similar to the USRDS report\(^4\). In this context, the gender paradox involves a higher rate of CKD in females, a lower rate of females on RRT and a better outcome for females on RRT. Similar to US, minority survival in Israel is better\(^6\). The Arab minority has a better survival on dialysis than the Jewish majority (HR 1.12 for Jewish population)\(^2\). Patients on dialysis with DM have a worse prognosis (HR 1.3 vs patients with glomerulonephritis)\(^2\).

Hemodialysis practice

Although hemodialysis (HD) sessions are typically thrice-weekly, 4-hr in length, in some patients sessions are shorter because of small body weight or because of non-compliance. Pump speed is typically 300-350 ml/min. Half (50.3%) of HD is provided by non-profit hospitals (31 centers) and half (49.7%) by for-profit community-based private dialysis networks (45 units). The median patient/Nephrologist ratio is 28.8 in hospitals and 36.5 in private units, while the median patient/Nephrology-certified nurse ratio is 5.4 and 13.9, respectively\(^7\) (the mandatory patient/all nurses ratio during HD session is 4:1 where at least one Nephrology-certified nurse must attend each separate room). In 1990 the market share of community HD units was only 4.6% but grew 10.5-fold by 2019. HDF has currently only a 5% market share but community dialysis units are currently upgrading the RO water systems to ultrapure level to allow sterile dialysis.
water grade for HDF. Home dialysis is practically unavailable at the moment, but as regulatory standards have been completed, delivery of home HD (HHD) in Israel is scheduled to begin in 2020 in the Haifa area.

The Israeli healthcare system and dialysis economics

Since 1995, Israel has had a National Health Insurance (NHI) providing a benefits package to all citizens and permanent residents of Israel, updated each year. The benefits package includes a broad list of services such as inpatient and ambulatory care, emergency and preventive care, diagnostic exams, and drugs. Compared to other OECD countries, Israel has had low health spending in the last decade (OECD report, 2014\textsuperscript{8}). Nevertheless, health outcomes have improved (OECD report, 2012\textsuperscript{8}) thereby placing Israel, according to Bloomberg health efficiency index report, in the 10\textsuperscript{th} place worldwide (Spain and Italy are in the 1\textsuperscript{st} and 2\textsuperscript{nd} places and the US is in the 35\textsuperscript{th} place)\textsuperscript{9}.

The NHI is financed predominantly from public sources collected via payroll and general tax revenues. Payment and provision of care are the responsibility of four competing nonprofit health plans (HPs), required by the NHI Law to provide services and to ensure reasonable accessibility and availability. For this purpose, HPs are funded by the MOH mainly through prospective payments according to a risk-adjusted capitation formula that considers the insured’s age, sex, and place of residence (periphery/center of the country). Small co-payments are required for outpatient visits, pharmaceuticals, visits to specialists, and certain diagnostic exams\textsuperscript{1011}. The four HPs manage the utilization and costs of healthcare services taking into account three key organizational objectives: cost containment, quality improvement, and equity promotion. For each HD or PD patient the government pays annually the HPs 65,000 USD from which the HPs cover the all medical costs, and containment is one of the HPs' main organizational objectives\textsuperscript{1011}. Consequently, HPs control costs by reviewing the utilization of dialysis care and opting for discounted bulk purchasing from dialysis providers, other care providers and pharmaceutical manufacturers. Hospitals in turn may maintain sufficiently large HD units to benefit from referral of HD patients to other hospital-based medical services rather than from direct revenues for HD sessions, as their personnel/patient ratio is higher than in the community dialysis networks. Because PD units require much less personnel, and there is hardly any cost for anti-coagulation or fibrinolytic drugs, PD is more profitable for the providers. In Israel PD providers are hospitals only and not private units. To avoid financial bias against PD, HPs are equally reimbursed for PD or HD patients (formal monthly MOH tariffs are for PD 178 USD per day X 31 days, and for HD 430 USD x 13 sessions per month) while the monthly cost of peritoneal fluid bags is estimated as 1570 USD per average patient. We do not have data for HHD as this practice is yet to be launched in Israel. Taken together, PD has the highest benefit/cost ratio.
Dialysis patient rights

Under the "law of serious illnesses" every Israeli inhabitant with ESRD is eligible for both free renal replacement therapy and free medications. Illegal immigrants that have been diagnosed with ESRD in Israel and started on dialysis are expelled to their country of origin on condition that dialysis services are accessible. Thus, because lack of accessible dialysis in their countries of origin may result in death for illegal immigrants with ESRD from some African countries, these patients remain in Israel on HD and incur huge debts that are never paid. For legal inhabitants however, dialysis treatments and medications are free, while fifty percent of transportation to dialysis units is reimbursed. For transplanted patients anti-rejection medications are free for life.

Staff

A general practitioner but not necessarily a Nephrologist is required to constantly attend the community-based dialysis units. The Nephrologist is required to determine the treatment plan and goals and check each patient at least monthly. In contrast, the nurses are the dominant sector in HD and PD. While a Nephrologist is the medical director taking individual medical and general operational decisions, the actual day-to-day acting managers of dialysis units in Israel are the head nurses. Nurses, but not technicians are authorized to cannulate the patients and are primarily responsible for the dialysis sessions by adhering to treatment protocols and doctor's orders and reacting to the patient condition. Technicians may only prepare the machines and dialyzer sets but have no access to patients. Dialysis nurses undergo a 1-yr Nephrology/Dialysis course to obtain certification to work in dialysis units. Finally, each dialysis unit must employ a dietitian and a social worker with a mandatory visit every month or 3 months, respectively.

Unique features of Israeli Nephrology

In addition to the high rates of DM as primary renal disease and of elderly patients on HD, a unique feature of ESRD in Israel is the recent dramatic rise in altruistic kidney donations. While, the overall transplant rate in Israel is 43 pmp (compared to 32 pmp European average and 62 in the USA), Israel is one of the few countries reporting a substantially higher rate of living donor rate than cadaver transplantation (60% living vs 40% deceased donors, compare to the US with 28% living vs 72% from deceased donors). Furthermore, within the living donors, there is a disproportionately high percentage of altruistic donors (54% altruistic vs 46% living-related donors). Since 2009 a dramatic increase of altruistic donations resulted in a uniquely high rate of 14 pmp in 2018 (compare to cadaver kidney donation rate in Israel of 17 pmp and a living-related donation rate of 12 pmp). While there is some dispute regarding harvesting from
brain-dead vs. cardiac arrest deceased donors in the Jewish rabbinic authorities, living related donation is encouraged in Israel\textsuperscript{12}.

Conclusions and future challenges

In our opinion the decline in both the rates of PD and permanent vascular access on initiation of HD can be improved by better ambulatory Nephrology practice. Unfortunately only 52\% of patients who begin dialysis in Israel had been seen by a Nephrologist within the 6 months before dialysis onset, thereby accounting for the low permanent vascular access on dialysis onset\textsuperscript{1,7} (Table 1). In contrast, 80\% of PD patients have been under regular Nephrology follow-up within the 6 months before dialysis onset. The lack of adequate patient preparation for RRT contrasts with the generally good preventive medicine in Israel. A relatively low number of Nephrologists (1.6 pmp) may partially account for the lack of adequate patient preparation for RRT in Israel. Lack of personnel is especially evident when comparing the periphery to the center of Israel; higher rates of AV fistulas and lower rates of mortality in the center of Israel compared to the periphery may indicate socio-economic and resource allocation differences.

References

1. Levy N. Dr Kurt Steinitz (1907-1966) and the 60\textsuperscript{th} anniversary of the first hemodialysis in the middle east. Harefuah 2010 149 (2):108-110.
2. Renal replacement therapy in Israel 1990-2015. Israeli Ministry of Health and the Israel Society of Nephrology and Hypertension, ICDC publication No. 367, Jerusalem, Israel, January 2018.
3. Kramer A et al. The European Renal Association- European Dialysis and Transplant Association (ERA EDTA) Registry Annual Report 2016: a summary. Clinical Kidney Journal 2019, 1-19.
4. United States Renal Data System 2016USRDS annual data report: Epidemiology of kidney disease in the United States.
5. Israeli Ministry of Health website. https://www.health.gov.il.
6. Kalantar-Zadeh K et al. Survival disparities within American and Israeli dialysis populations : learning from similarities and distinctions across race and ethnicity. Seminars in Dialysis 2010; 23(6):586-594.
7. Israeli MOH, department of quality control, dialysis units control report 2019.
8. OECD 2012 and 2014 reports. www.oecd.org.
9. Bloomberg website.
10. https://www.oecd.org/els/health-systems/Better-Ways-to-Pay-for-Health-Care-Background-Note-Israel.pdf
11. Brammli-Greenberg S., Waitzberg, R., Medina-Artom, M., Adijes-Toren, A. (2014), “Low-Budget Policy Tool to Empower Israeli Insureds to Demand their Rights in the Healthcare System”, *Health Policy* 118 (2014), pp. 279-284.

12. Wasser WG et al. Emergence of an Israel faith-based community organization facilitating live donor kidney transplantation. BMC Nephrology 2018; 19:128.

13. Reese PP et al. Brammli-Greenberg S., Waitzberg, R., Medina-Artom, M., Adijes-Toren, A. (2014), “Low-Budget Policy Tool to Empower Israeli Insureds to Demand their Rights in the Healthcare System”, *Health Policy* 118 (2014), pp. 279-284. Lancet 2015.
| Question                                                                 | Answer                                                                 |
|-------------------------------------------------------------------------|------------------------------------------------------------------------|
| Number of dialysis patients                                             | N=6694 742/pmp                                                         |
| Percent of patients on home dialysis                                    | HHD-0.03%  PD-7.1% (APD 30%, CAPD 70%)                                  |
| Are all dialysis sessions covered by insurance, or do some patients have out-of-pocket expenses | Covered by insurance                                                   |
| Are the dialysis units hospital-based or freestanding?                  | Both                                                                   |
| Are the dialysis units for-profit or non-profit?                        | Hospitals-non-profit Community-for profit                               |
| What is the reimbursement per dialysis session in $US?                  | HD-430 per session  PD-178 per day                                      |
| Are all the staff who deliver dialysis nurses or do you also use patient care technicians? | Dialysis nurses only                                                   |
| What is the typical patient to RN ratio in the dialysis units?          | 4:1                                                                    |
| What is the average length of a dialysis session?                       | 240 min                                                                |
| How many times per month are patients seen by a nephrologist during dialysis sessions? | 1                                                                      |
| What is the proportion of prevalent HD patients in your country using an AVF, AVG and CVC? | AVF-60%  AVG-8%  CVC-32%                                               |
| What is the proportion of incident (day 1) HD patients in your country using an AVF, AVG and CVC? | AVF-18%  AVG-2%  CVC-75%  Temp. Catheter-5%                              |
| What is the rate of kidney transplantations?                            | 43 pmp, 60% living, 40% deceased                                       |
|                                   | 1990     | 2015     |
|-----------------------------------|----------|----------|
| RRT Incidence                     | 113 pmp  | 196 pmp  |
| RRT Incidence of men              | 144 pmp  | 258 pmp  |
| RRT Incidence of women            | 81 pmp   | 135 pmp  |
| Incidence of patients >75-yr old  | 632 pmp  | 1219 pmp |
| Prevalence of patients >75-yr old | 1015 pmp | 4871 pmp |
| DM as primary renal disease       | 18%      | 44.5%    |
| Ratio of incident 75-84 age group compared to incident 20-44 yr-old | 7-fold   | 27-fold  |
| Prevalence of functioning kidney graft | 81.5 pmp | 420 pmp  |
| Percentage of PD of all dialysis  | 34.2%    | 7.1%     |