

DIALYSIS/TRANSPLANTATION ΑΙΜΟΚΑΘΑΡΣΗ/ΜΕΤΑΜΟΣΧΕΥΣΗ

History of nephrology in the Arab world

Nephrology was first recognised as a specialty in 1960, haemodialysis (HD) first used in clinical practice in 1960–1965 and peritoneal dialysis (PD) in 1978. Egypt started dialysis in 1958 with a first dialysis department in 1979. Currently, there are 70,000 HD patients in Egypt. Algeria performed PD, HD for acute cases in 1962 and 1971 respectively. In Sudan, there are 60 dialysis centres, treating 6000 patients; of these 122 are on PD. The first haemodialysis was performed in Iraq in 1964. Morocco started HD in 1978. Saudi Arabia entered the field of HD in 1972; currently there are 184 dialysis units, while PD started in 1980. Dialysis in Yemen began in 1980. The Syrian national dialysis program was launched in 1986. Tunisia used PD for acute cases in 1962 with the first artificial kidney one year later. Nowadays, there are 13 dialysis units. Jordan performed its first dialysis in 1968; today there are 84 HD centres. The United Arab Emirates initiated PD in 1976 and HD in 1977. The first two dialysis units in Libya came in 1971 and 1979. Lebanon used PD for acute cases in the late fifties and started PD in 1994; currently there are 61 HD centres. The Oman Nephrology service started in 1981 and first PD patient was treated in 1983. In Kuwait, dialysis started in 1976 and today there are 9 centres. Qatar introduced PD in 1976 and HD in 1981. Lastly, Bahrain started HD in 1972. Highlighting this history sheds light on Arab experiences, aiming for achievements in the future.

1. INTRODUCTION

Nephrology was first recognised as a specialty in 1960. Haemodialysis (HD) was first used in clinical practice in 1960–1965 and Continuous Ambulatory Peritoneal Dialysis (CAPD) in 1978. Nephrologists in Arab countries entered the field of nephrology at different points in time.

2. EGYPT

Egypt started dialysis in 1963 in Cairo University Hospital. The first independent not academic chronic hemodialysis unit was established in 1979. The service spread to universities, general, military and private hospitals with the establishment of the Egyptian Society of Nephrology in 1965 and the first national congress in 1981. Mohammed Nagy El-Mahallawy was the Founder of Nephrology at Ain-Shams University and the physician behind the first dialysis experience in Egypt. He established what he called a nephro ward in the late fifties. The two first-generation nephrologists were Ismail Abou-Gabal and Mohammed Sadek Sabbour. Abou Gabal was sent to Lund, Sweden where he was trained on the Alwall dialysis machine under its inventor,

Nils Alwall himself. Sabbour was directed to Edinburgh, United Kingdom (UK) for obtaining his PhD in clinical nephropathology, Abou-Gabal along with Sabbour and Wahid-El-Saiid, were the first to report, in 1972, the occurrence of nephritis in patients with urinary schistosomiasis, which turned out to signal important discoveries about this parasitic infection by other groups in the following years. In Cairo University, Sayed Taha Abdel-Bar and Anwar El-Mofti had a particular interest in kidney disease and its associated metabolic disorders. By the late 1950s, they foresaw two areas of promising development related to kidneys; (a) the revolutionary understanding of renal physiology as a result of evolving micro-puncture techniques, and (b) the imminent promise of dialysis for the ground-breaking management of acute and chronic renal failure. Hassaballa introduced dialysis in 1963 and renal biopsies in 1968 at Kasr El-Aini. He pioneered the first nephrology unit in the Internal Medicine tower and founded the first dedicated to chronic dialysis ward at Manial University Hospital in 1979. In Alexandria, dialysis services were initiated at the Medical Research Institute (MRI), initially an independent body established in 1957, subsequently attached to the National Research Centre (NRC) and later on affiliated with

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Ιστορία της Νεφρολογίας
στον αραβικό κόσμο

Περίληψη στο τέλος του άρθρου

Key words

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Alex University. El Banawy established the first dialysis unit outside the capital in 1966, with Kolff-Travenol machines. By 1970, Aziz Zaki was the leading nephrologist at Alexandria University Medical School. Atef Hozayen introduced haemodialysis (HD) (using a Kiil system) in Alexandria University in 1974. Salah Naga practiced APD (1972) in ICU, pioneered this modality for the rest of his career and established a separate PD unit. El Belbessi started CAPD in 1980. El Kashif, Aggan, El Lakany followed. Mohammed Ghonaim, founder of the Urology Department at Mansoura University, started acute peritoneal dialysis for acute renal failure in 1969. This experience was limited due to the shortage of equipment and some technical difficulties. HD was started the following year, using a Lucas machine and Kiil dialyzers, which were replaced by a Kolff-Travenol machine in 1974 with the aid of Mohamed Gaballa. Then Ghonaim appointed two nephrologists, Adel Bakr and Nabil Hassan, who took over. Adel Bakr established the first two clinics of nephrology, created vascular access, established an HD unit main hospital and two annexes, organising daily morning meetings and then became the unit chief. Later, Mohammed Sobh joined the team after returning from Canada and became the unit chief (1981). The Nasser Institute for Research and Treatment opened in 1987, incorporating a large dialysis service under the supervision of Maher Ramzy; Essam Khader joined at the end of the millennium. The Zagazig nephrology school started with Mohammed Zanati performing peritoneal dialysis treatment using customised connections and fluids. In 1977, he started the HD service with Travenol Twin-coil machines. A couple of years later, Essam Lotfy joined the team, followed by Ahmed Adel Hassan for a short while before moving overseas. In the late 1970s, several members of the Internal Medicine Department, namely Essam Amin, Khaled Talaat and Esmat Ezzat, helped develop the Suez Canal University. Assisted by Assem El-Sherif, they started dialysis in Ismaileya in 1980. Banha University joined the club in 1984 with El-Metwally El-Shahawy who established a nephrology unit in 1992. Nabil Zekralla introduced clinical nephrology at the Al-Azhar medical school in 1985, using a Lucas machine that was replaced by a Kolff-Travenol. Zekralla trained excellent second-generation nephrologists, including Ezzat El-Atrebi, Safwat Farag, Hussein Chahine and Tarek Al Baz. Lastly, Egyptian nephrologists maintained the tradition of excellence their grandfathers had established many centuries ago. Egyptian renal Centres indeed existed before some advanced centres in the developed world. Egypt produces high-quality research that keeps it on the top of the African and Arab world. Currently, there are 70,000 HD patients in Egypt.

3. ALGERIA

Algeria performed PD and HD for acute renal failure from 1962 to 1971 in Mustapha University Hospital. The treatment spread from the Reanimation unit of E1 Kettar University Hospital (1971–1973) by PD to HD (four machines) in the same hospital (1973). In 1978, it started treating ESRF and then Badis University started treating ESRF in 1975. The opening of the first unit of nephrology consultation and clinical hospitalisation came in 1977. In 1978, the first chronic haemodialysis and automated peritoneal dialysis unit opened there. In 1979, CAPD started in the same unit and two satellite centres HD (Hospital of Rouiba and Hospital of Kolea). Later, the immuno-histopathological laboratory opened in Beni-Messous Hospital and a research program about diseases responsible for renal insufficiency was launched in the same hospital in 1986. 50 new chronic HD centres opened between 1980 and 1994. Between 1995 and 2003, only one centre was opened. Before 1988, all Algerian nephrologists specialised in France.¹ Today, Algeria has 450 HD centres (280 public, 170 private), 24,000 patients treated by HD, 1,200 patients treated by CAPD, nephrology specialisation is provided in 13 universities, each year 50 new nephrologists obtain a diploma. The prevalence of end-stage renal disease (ESRD) is 100/million inhabitants. Algerian authorities are in charge of paying all bills for dialysis treatment through the Algerian Kidney Foundation since 2015.

4. SUDAN

In Sudan, the reported prevalence of ESRD is 70–140/million inhabitants, with mean of 106. The National Centre for Kidney Diseases and Surgery was established in 1994 to supervise healthcare services offering RRT. 60 dialysis centres were established, 40 of them in Khartoum city; 6,000 patients are on HD. The National Program for PD was established by Prof Abu Aisha (2005), with 122 patients. Prof Hasan Abu Aisha received the ISN pioneer award for the Africa Region (2017). The number of trained nephrologists has now increased to 0.7 per 1 million of population (pmp) compared to 17.5 pmp in the USA.²

5. IRAQ

In Iraq, the first HD was performed in 1964 and CAPD followed later. The first artificial kidney device was imported (1964) for possible use in open heart surgery. A Kiil machine was then brought from Germany. Later, Locus machines were purchased for Rasheed military hospital.

The first arteriovenous (AV) fistula was carried out in 1971. Rifat imported a CAPD catheter (Oreopoulos design) from Canada and subsequently introduced CAPD in Iraq. In 1994, a first Ministry of Health (MOH) conference was assisted by international figures from European countries.¹

6. MOROCCO

In Morocco, HD was introduced in 1978 in Ibn Sina University Hospital in Rabat, PD was used at the Ibn Rochd University Hospital in Casablanca in the early 1980s. Only patients with social security coverage benefited from HD. Later, thanks to benefactors' associations a culture of aid and support for dialysis was established. Several centres opened, designed for disadvantaged patients with no social security coverage.³ The associations allowed dialysis to take place in Tangies, E1 Jadida, Massakeech and Agadir. In 1996, patient numbers reached 200, with two 5-hour sessions/week each.⁴ In 2003, MOH opened 11 centres with the establishment of compulsory health insurance. In 2008, MOH recognised ESRD as a public health issue. At first, the prevalence was 102.09 PMP (2005) and subsequently increased according to the Magredial registry and a Moroccan Society of Nephrology survey.⁵

7. SAUDI ARABIA

Saudi Arabia introduced HD in 1972 with a first dialysis centre in Riyadh General Hospital, led by Dr Saeed Rabah with two Travenol machines. A second dialysis unit was created in Jeddah, Bab Shareef Hospital, established by Dr Adan Birkdar (Iraq), after he left the Riyadh unit with the first Saudi resident, Dr Faten Shaker. The third unit was established in Medina in 1975 and the fourth in Alzahr Hospital in Makka in 1976. Prof Abuaisa (Sudanese) joined the King Saud University faculty and helped in operating the dialysis unit at the King Saud Central Hospital. The first fully certified Saudi nephrologist was Dr Tashkandi who joined the King Saud Central Hospital in 1974 and started nephrology and dialysis at the King Faisal Hospital in Taif in 1981 with Traverol, B. Brown and Gambre AK10.⁶

A dialysis unit at the Dammam Central hospital was established in 1975 by Dr Fawzi Awad (Egyptian) with two Travenol machines. It was expanded in 1983 by Dr Ayman Kartar (to 24 AK10 machines) in parallel with his establishment of the Kanoo HD centre in 2001 with 87 state-of-the-art machines. The classic vascular access used a Scribner shunt, patients were sent to Beirut, Cairo, USA, and the UK for AVF creation. Up to when Dr Abdulraheem Miaulana

started in Alzahr Hospital in Makka, the dialysate bath was acetate until 1994, where bicarbonate was distributed.⁶

There was an exponential proliferation of units across the country, thanks to many dedicated nephrologists and nurses. The 2010 DOPPS study included 184 dialysis units and 15,000 patients treated by HD or PD and Kingdom of Saudi Arabia (KSA). Due to increasing numbers of patients requiring HD (incidence 187 new patients PMP), MOH formulated a committee to outsource a program to the Diaverum and DaVita companies (2014) to provide dialysis, treating 4,000 patients.⁷ On-line haemodiafiltration (HDF) was introduced by Dr Al Meshari in 1998 in Riyadh and Dr Al Ghamdi in Jeddah one year later. PD was introduced in 1980 by Dr Abu Aisha as IPD and then CAPD. Dr Mitwally and Al Wakeel led the program at the King Saud University. Later, Dr Al-Hwiesh joined Damman University, inventing the three-cuff Saudi PD catheter. Currently, there are two PD units and KSA has the largest number of PD patients in the Middle East.⁸

8. YEMEN

In Yemen, dialysis began in 1980 as a nephrology department was created at Al-Thaowra General Hospital (Sanaa) with 16 beds and two HD machines, increased to 8 machines in 1985. An Urology & Nephrology Centre was opened in 2004 (110 beds). Of these, 40 beds were for nephrology patients and the machines increased to 29. There are 120 new reported ESRD cases per million/year. New dialysis centres were created at the Military Hospital (Sanaa, 1987) then Hudidah (1992), Hajjah and Taiz (1993). After Yemen Unity, HD services were expanded to Aden (1993), Mukalla (1996) and Shabura. Currently, there are 33 centres, 3,797 patients, and 401 machines. PD started in Yemen in 1980 in a small centre at Al-Thawra Hospital. In 1990, eight PD cyclers were available at that centre with a similar number in the new centre. Intermittent Peritoneal Dialysis (IPD) was commonly used; 750 patients were treated with intra-peritoneal dialysis (IPD) in 1991, while in 2015, the number reached 1,600. Only 16 patients were treated with CAPD in 1990/1991. This stopped in 1992 due to complications and financial issues.¹

9. SYRIA

In Syria, until the seventies, the treatment of renal failure was limited (lack of dialysis services). In the mid-seventies, a law was passed, providing free medical services to CRF patients including transplantation. The first

group of specialised nephrologists graduated and were allocated throughout the country in the mid-eighties, and well-equipped HD centres subsequently opened. These steps created the conditions for the establishment of the National Dialysis Program (NDP) in Syria in 1986, which expanded to include both haemodialysis and peritoneal dialysis, using Syrian-made solutions.¹

10. TUNISIA

In Tunisia, the history of nephrology can be subdivided into three periods: launching of the specialty, development of adequate departments in the regions and development of transplantation. After his appointment as head of the medicine department (ward 10–3) at Charles Nicole Hospital in 1962, Prof H. Ben Ayed introduced PD to treat acute kidney failure. The first artificial kidney was used in 1963, then Drake Willock functioning with a Kiil dialyzer was introduced in 1969; reverse osmosis started in 1971. The available access was the Scribner A-V shunt; then the Cimino-Brescia fistula was introduced. Renal biopsies were carried out initially surgically and then by puncture with a Silverman needle. By the end of 1974, two graduate nephrologists from France (Ben Maiz and El Matri) were recruited in the department. A pathology lab was established (Ben Moussa). An IPD program was set up and then came CAPD in 1983. The input of Ben Abdalla (plasma exchange) and Kheder (hypertension lab) is well-known.

The Military Hospital of Tunis was set up in 1977 by the director of the General Hospital Dr Ben Moussa, under the responsibility of Dr M. Dhahri, who was appointed head of the Anaesthesia Department in 1980. A centre in Sousse (140 km south of Tunis) was founded in 1981. As regards decentralisation, Monastir started acute PD and then HD in 1981 (Prof El May), Sfax started a program in 1982 (Prof Hachicha) and Sousse hosted HD and CAPD programs (2006) (Prof Achour).⁹

11. JORDAN

Jordan performed its first dialysis in 1968 at the main military hospital. The first home dialysis unit was brought in 1969. The first dialysis device model was Travenol and then the REDY sorb system in 1981. The prevalence of HD patients is 627 PMP. In 2015, there were 3,937 dialysis patients, 25 PD patients, 84 dialysis centres and 950 dialysis machines. Jordan, like other developing countries, suffers from a high rate from diseases that mostly lead to kidney failure, such as arterial hypertension (25%), high blood lipids (42%), high levels of obesity (36%), diabetes (43%),

and cancer (75:100,000). The dialysis services are provided by MOH, royal medical, private or university hospitals. Hepatitis C-positive patients accounted for 2.5% while HBV infected patients represented 6.4%.¹

12. UNITED ARAB EMIRATES

In the United Arab Emirates (UAE), the history of nephrology services is linked to the history of the Abu Dhabi renal unit. Dr Avinash Pingle was responsible for setting up the first dialysis unit in the UAE and for introducing nephrology as a specialty. The Central Hospital in Abu Dhabi was the only centre offering such services until 1980 and they received patients not only from the UAE but also from neighbouring countries such as Oman and Bahrain. The first PD program was initiated in 1976 and the first chronic haemodialysis program was established in 1977. The service then extended to 9 emirates of the country. Now there are more than 35 dialysis units, belong to the private governmental sectors.¹

13. LIBYA

In Libya, the first separate dialysis unit was in Benghazi (Al Hawari Hospital) in 1971. The second dialysis unit was in Tripoli (Tajoura) in 1979.¹⁰ The prevalence of dialysis-treated CKD is 624 PMP, with most (85%) under age of 65, white (87%), and male (58%). The causes of ESRD included DM (26%), chronic glomerulonephritis (21%), hypertensive nephropathy (14%), and congenital/hereditary diseases (12%).¹¹ Only 4.7% of patients were known to be infected with HCV or HBV before starting dialysis. The seroconversion rate is 7.7% (7.1% for HCV, 0.6% for HBV). The World Health Organization (WHO) assigned Prof Adel Bakr as short-term consultant to Libya in 1997 and 1999 and he advised an action plan to improve healthcare services for renal patients.¹²

14. PALESTINE

In Palestine, in 2016, there were 1,002 patients on HD in the West Bank and 724 patients in Gaza. The prevalence of CKD is 10%, increasing yearly even among young people. The number of newly reported ESKD cases was 117, while the unadjusted incidence rate was 363/million/year.

15. LEBANON

In Lebanon, acute dialysis was launched by Am University Hospital in the late fifties. In 1973, the Lebanese Nephrology Society was established; in 1974, there were

5–6 nephrologists registered while the current number is 124 nephrologists. HD is provided free of charge, with 3,400 patients currently on HD in 61 centres. CAPD was introduced in 1994; the 50 patients of 2004 now reach 180 patients. Nephrology and its related subspecialties have gone a long way. Financing and many essential links are still missing but Lebanese nephrologists hope to take care of them soon.¹³

16. OMAN

In Oman, the nephrology service started in 1981; the first PD patient was treated in 1983 and the second –a child– was initiated on paediatric HD in 1992. The service grew thanks to the efforts of Dr Al-Marhuby. The first nephrology department was established late in the same year at Al Nahda Hospital, including clinical nephrology, HD, IPD and kidney biopsies.¹⁴ MOH (1990) decided to establish dialysis centres in various governorates, with more than 20 such units currently operating. Paediatric HD centres became available in 1992 (Lawati NM). The national registry for CKD and dialysis was initiated by Dr Al Marhuby in 1998. DM emerged as a major non-communicable disease from 1980. Combined diabetic and hypertensive nephropathy represents 70% of aetiologies of ESRD on regular replacement treatment (RRT) while 40% of dialysis patients were diabetic. At present, there are 1,500 dialysis patients.¹⁵

17. KUWAIT

In Kuwait, dialysis started in 1976 at the Al Amiri Hospital. Dialysis is used in 400 cases/million population. Currently, 2,006 patients are receiving dialysis in nine big dialysis centres, distributed across the country. 88% are treated by HD and 12% receive PD. MOH divided the country to 6 health regions; each has a general hospital providing full adult nephrology services, while paediatric nephrology services are provided in two hospitals only. Regarding the nephrology services, Mubarak Al Kabeer Hospital started dialysis in 1983 with 12 beds for two shifts, increased to 30 beds for 4 shifts, with a new dialysis unit in 2015. The Jaber A. Ahmed Dialysis Centre in Jahra Hospital started in 2000 with 16 beds, increased to 30. A new centre was opened in 2013, including a paediatric dialysis centre and 10 beds for HCV and 4 for HBV infected patients. The Farwaniya Dialysis Centre was established in 2011 with 56 haemodialysis stations and 10 PD beds. The Al Khezam Dialysis Centre in Adan Hospital started in 2009 with a large nephrology program, including teaching and research. The Al Nafisi Dialysis Centre, a satellite centre belonging to Al

Sabah Hospital, includes 280 patients (HD, PD). Dialysis access surgeries and kidney biopsies are carried out in all above hospitals, while complicated cases are referred to the Hamed Al Essa Organ Transplant Centre. A new Nephrology and Transplant Centre is being constructed and is to function soon.¹

18. QATAR

Qatar introduced PD in 1976 at Rumaillah Hospital. In 1981, the first HD unit was created at same hospital (4 machines) with local dialysate preparation. In 1982, the Hamad Medical Corporation started with a subspecialty of nephrology: 40 outpatient clinics/week for nephrology and transplantation. A special low clearance clinic (medical educator, dietitian and social workers) was established. Currently, it provides 250,000 HD sessions per year (2016). The incidence of ESRD was 205/million population in 2015, with diabetes mellitus (DM) as a leading cause representing 48%, HCV positivity down to 10.5%. CAPD started in 1997 and grew rapidly.¹⁷ Acute kidney injury is an important cause of morbidity and mortality (volume depletion, sepsis, and hypotension). Currently, the adult nephrology workforce consists of 16 consultants, 14 specialists and 2 fellows at 8 hospitals in addition to satellite dialysis units.¹⁶

19. BAHRAIN

Lastly, Bahrain started HD in 1972, when Dr Al Arayed returned from the UK, with only one patient receiving dialysis therapy for one year. The incidence of ESRD in Bahrain is 120 PMP. HD continues to be the major management modality for ESRD patients. In 1981, the dialysis unit included 4 machines, up to 10 in 1988. The new unit started operating in 1992. 390 patients are on dialysis; nearly 30% of them need transplantation. Diabetic nephropathy rates are increasing.¹

Highlighting this history sheds light on Arab experiences, aiming for achievements in the future.

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ΠΕΡΙΛΗΨΗ

Ιστορία της Νεφρολογίας στον αραβικό κόσμο

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Η Νεφρολογία αναγνωρίστηκε ως ειδικότητα για πρώτη φορά το 1960. Η αιμοκάθαρση εφαρμόστηκε για πρώτη φορά στην κλινική πρακτική το 1960–1965 και η περιτοναϊκή κάθαρση το 1978. Η Αίγυπτος άρχισε να χρησιμοποιεί αιμοκάθαρση το 1958 δημιουργώντας ένα πρώτο τμήμα αιμοκάθαρσης το 1979. Σήμερα στην Αίγυπτο καταγράφονται 70.000 αιμοκαθαιρόμενοι ασθενείς. Η Αλγερία χρησιμοποίησε για πρώτη φορά περιτοναϊκή κάθαρση και αιμοκάθαρση για οξείες περιπτώσεις το 1962 και το 1971, αντίστοιχα. Στο Σουδάν, μετρώνται 60 κέντρα αιμοκάθαρσης, που παρέχουν θεραπεία σε 6.000 ασθενείς. Από αυτά, στα 122 χρησιμοποιείται περιτοναϊκή κάθαρση. Στο Ιράκ, η πρώτη αιμοκάθαρση πραγματοποιήθηκε το 1964. Στο Μαρόκο, η αιμοκάθαρση άρχισε να χρησιμοποιείται το 1978. Η Σαουδική Αραβία εισήλθε στον τομέα της αιμοκάθαρσης το 1972. Σήμερα διαθέτει 184 μονάδες αιμοκάθαρσης, ενώ το 1980 άρχισε να χρησιμοποιεί και περιτοναϊκή κάθαρση. Στην Υεμένη, η αιμοκάθαρση άρχισε να χρησιμοποιείται το 1980. Το 1986, άρχεται η εφαρμογή του εθνικού προγράμματος αιμοκάθαρσης της Συρίας. Η Τυνησία χρησιμοποίησε για πρώτη φορά περιτοναϊκή κάθαρση για οξείες περιπτώσεις το 1962, και ένα χρόνο αργότερα διέθεσε τον πρώτο τεχνητό νεφρό. Σήμερα, διαθέτει 13 μονάδες αιμοκάθαρσης. Η Ιορδανία πραγματοποίησε την πρώτη αιμοκάθαρση το 1968. Σήμερα διαθέτει 84 κέντρα αιμοκάθαρσης. Τα Ηνωμένα Αραβικά Εμιράτα άρχισαν να χρησιμοποιούν περιτοναϊκή κάθαρση το 1976 και αιμοκάθαρση το 1977. Το 1971 και το 1979 δημιουργήθηκαν οι δύο πρώτες μονάδες αιμοκάθαρσης στην Λιβύη. Ο Λίβανος εφάρμοσε περιτοναϊκή κάθαρση για οξείες περιπτώσεις στα τέλη της δεκαετίας του 1950 και άρχισε τη χρήση περιτοναϊκής κάθαρσης το 1994. Σήμερα διαθέτει 61 κέντρα αιμοκάθαρσης. Η υπηρεσία Νεφρολογίας του Ομάν άρχισε τη λειτουργία της το 1981 και το 1983 υποβλήθηκε σε θεραπεία περιτοναϊκής κάθαρσης ο πρώτος ασθενής. Στο Κουβέιτ, η αιμοκάθαρση άρχισε να εφαρμόζεται το 1976 και σήμερα υφίστανται 9 κέντρα. Το Κατάρ εισήγαγε την περιτοναϊκή κάθαρση το 1976 και την αιμοκάθαρση το 1981. Τέλος, το Μπαχρέιν άρχισε να χρησιμοποιεί αιμοκάθαρση το 1972. Η ανάδειξη αυτής της ιστορίας καθιστά πιο σαφείς τις αραβικές εμπειρίες, αποσκοπώντας σε μελλοντικά επιτεύγματα.

Λέξεις ευρητηρίου: Αίγυπτος, Αιμοκάθαρση, Αραβικός κόσμος, Ιστορία αιμοκάθαρσης, Ιστορία Νεφρολογίας, Χρόνια νεφρική νόσος

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