

DIALYSIS/TRANSPLANTATION ΑΙΜΟΚΑΘΑΡΣΗ/ΜΕΤΑΜΟΣΧΕΥΣΗ

A journey through the history of dialysis in sub-Saharan Africa

Sub-Saharan Africa (SSA) is a heterogeneous region with 47 countries, almost one billion people, and a gross domestic product of 1.7 trillion USD in 2017. The development of dialysis in Africa reflects the local socio-political circumstances. Up to seventies, Africa was recovering from long years of colonisation and political turmoil, so limited countries were able to establish dialysis centres. (a) *Before the seventies*: South Africa was the first country in SSA that started dialysis, when, in 1957, a general practitioner in Krugersdorp hospital dialysed 2 patients with acute kidney injury (AKI). In Kenya, acute haemodialysis (HD) was started in 1961 by Professor *L.S. Otieno*, followed by peritoneal dialysis (PD) two years later. In Nigeria, limited acute dialysis has been available in Lagos since 1965 and acute PD in Ibadan since 1967. Regular HD was firstly established at Lagos Teaching Hospital in 1981 by Professor *T.A. Odotola*. In Sudan, the first dialysis centre was a home dialysis unit, established in 1968, supervised by Mr. *Osman Awadalla*. (b) *After the seventies*: In Côte d'Ivoire, the first acute PD was performed in 1974 in Abidjan by Professor *Alain Bondurand* to treat a black fever patient with AKI. In Zimbabwe, Drs *John Forbes and Janet Seggie* placed a dialysis machine in Harare Central Hospital in the early 1970s; yet the machine was only occasionally used for the treatment of AKI until 1980. In Ethiopia, PD dialysis and less often HD was started in 1980 as reported by Dr *Berhanu Habte* to treat AKI at Addis-Ababa University Hospital. In Tanzania, Dr *J. P. Miabaji* reported that two dialysis machines were available at Dar-El-Salam University Hospital in the early 1980s, to treat AKI or important patients with plans for transplantation abroad. In Ghana, Dr *T.C. Ankrah* provided acute PD and sometimes HD for AKI in 1980. Other SSA countries started to establish dialysis units afterwards. However, dialysis services are still sparse in most countries due to the high costs and shortage of skilled personnel.

1. INTRODUCTION

Sub-Saharan Africa (SSA) is the area of Africa that lies south of the Sahara desert. It is a vast and heterogeneous region, comprising 47 countries and a population of almost one billion people. In 2018, the aggregate gross domestic product (GDP) per capita in SSA amounted to 4,097.85 USD. About 65% of the population lives in rural settings, at significant distances from cities, where most of the organised health-care delivery systems are located.¹

Chronic kidney disease (CKD) and its severe form, end stage kidney disease (ESKD) are a global public health problem with a high economic cost for the health system. Epidemiological data on CKD and ESKD in SSA are sparse and those existing are of limited reliability due to the dearth

of renal registries in most countries. According to recently published data, the burden of CKD in SSA is determined to be around 14%,^{2,3} close to the global CKD prevalence (13.4%).⁴

Since the end of the previous century, there has been an upsurge in the number of people with ESKD requiring renal replacement therapy (RRT).⁵ Globally, the number of people requiring RRT was estimated at 4.9–9 million. Only 3.3 million people are receiving RRT, the majority of which in the developed world, while less than 5% of the pool of global RRT is available in SSA.^{6,7} Of all world regions, Africa has an immense RRT gap between people needing and receiving RRT, of over 80%. Even though it is projected that people receiving RRT will double from 2010 to 2030 in Asia and Africa, the number of people without access to treatment is expected to remain excessively high.⁸

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Ένα ταξίδι στην ιστορία
της εξωνεφρικής κάθαρσης
στην υποσαχάρια Αφρική

Περίληψη στο τέλος του άρθρου

Key words

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The evolution of dialysis in different African countries has been almost the same, with differences only in timing. Acute peritoneal dialysis (PD) was often the first available modality, soon followed by acute haemodialysis (HD). With the introduction of RRT, intermittent PD and HD were used according to the feasibility and availability of monetary and human resources. Continuous ambulatory peritoneal dialysis (CAPD) usually came later, and had an initial glamour that soon faded owing to the high cost of imported dialysis fluid.⁹

In this review, we tried to provide an overview of the history of dialysis in different SSA countries based on available data. In addition, we focused on the difficulties SSA faces in implementing national dialysis programs. We illustrated the starting year of dialysis in different sub-Saharan African countries in figure 1.

2. FROM THE SEVENTIES TO THE CURRENT ERA

Democracy brought about many changes in Africa after the seventies. Before this, colonialism was responsible for Africa's difficulties, which affected all aspects of life and development in different countries. The diverse and heterogeneous post-independence political turmoil in individual countries was reflected in the timing, quality, and spread of dialysis services in different regions. Within this environment of political instability, certain countries were lucky enough to have a "powerful patient" with ESKD who had the power and influence to push the introduction of dialysis services. In the absence of personal motivation however, most political regimes regarded dialysis as an unaffordable luxury, and definitely not a priority issue.¹⁰

2.1. The first step

South Africa hosted the first dialysis in the African continent. In 1957, an amateur general practitioner at a state hospital in the small town of Krugersdorp built the first dialysis machine, based on his observations in the United Kingdom, as a hybrid between a Kloff coil and a rotating drum. This machine was used to dialyse two acute kidney injury (AKI) patients, who unfortunately died later (as noted by Professor Anthony Meyers).⁹

2.2. Steps forward

This was followed by the initiation of dialysis in Kenya by Professor L.S. Otieno at Nairobi General Hospital in 1961. It started with the introduction of acute HD, followed by acute

PD two years later. In 1984, regular HD for ESKD started and after 3 years, Professor Seth O. McLigeyo introduced CAPD, while haemofiltration was established in 1992.⁹

Nigeria was the first country to start dialysis in West Africa. Limited acute HD had been available in Lagos since 1965 and acute PD in Ibadan since 1967. Regular HD began later due to the sociopolitical instability prevailing for many years. In 1981, the Lagos University teaching hospital implemented regular HD, on the initiative of Professor T.A. Odutola. This progressed into a national program in 1985, where several other centres providing regular HD and occasional CAPD to several hundreds of patients, as reported by Dr Fatiu Arogundade.⁹

At the end of the sixties, Sudan established the first home dialysis unit to treat an important Sudanese citizen, under the supervision of Mr. Osman Awadalla, who received his training in the USA and returned home with a Kiil dialyzer. After the patient's death, the machine was transported to Khartoum General Hospital, where it became the seedling for the first hospital dialysis centre in the country. The same centre also introduced PD and included a chemistry laboratory, sponsored by the Korkain Skendrian family. In 1985, Khartoum University built an independent dialysis centre in Soba, largely sponsored by individual donations. This was directed by Prof. Omar Abboud, considered the Father of the progress of dialysis in Sudan. He was aided by Dr Salma Suliman, who developed the first paediatric dialysis service in the country. This service was later named after her, following her tragic death in the Nile, during her daughter's marriage celebrations. Suliman's centre remains one of the pillars of the national CAPD program adopted in 2005 at two paediatric and seven adult centres.¹¹⁻¹³

2.3. After the seventies

In 1974, the first acute PD was performed by Professor Alain Bondurand on a case of black water fever diagnosed in Côte d'Ivoire in Abidjan. Two years later, HD was initiated. Both modalities used for the treatment of malarial AKI. Regular HD was started at the same time; however, patients did not follow the plans regularly, as they were not convinced to continue treatment while feeling well. This in turn led to a 30% survival rate, as reported by Professor Gnionsahe Daze.⁹

In parallel to these developments in Côte d'Ivoire, both Drs John Forbes and Janet Seggie placed a dialysis machine in Harare Central Hospital in Zimbabwe. This machine was only used for the treatment of AKI until the early eighties. Later, the country's first lady, Sally Mugabe, received

regular HD in the UK; after returning to her country, she brought her own machine and treating doctor, who was responsible for developing a chronic dialysis program in the country. In May 1988, the Minister of Health declared RRT a national commitment, and set up a Renal Committee at Parirenyatwa Hospital for patient selection on the sole basis of medical criteria (information kindly provided by Dr Chiratidzo Ndhlovu).⁹

In Ethiopia, Dr Berhanu Habte showed a great interest in renal diseases. In 1987, during an African countries meeting, he mentioned that PD and, less often, HD were sporadically available for AKI at Addis-Ababa University Hospital. In 2002, dialysis was no longer available in Ethiopia. Later on, an agreement with Professor Marc De-Broe was established to provide them with PD catheters, lab quality control, and a water treatment plant. Two more fellows were trained in South Africa, in 2005 and 2007, but no organised RRT program has been available so far.⁹

During the African Association of Nephrology (AFRAN) meeting in 1987, Dr J.P. Miabaji indicated that two dialysis machines were available at Dar-El-Salam University Hospital, and were used only for AKI or when VIPs with ESRD planned receiving a transplant abroad. Sixteen years later, a young physician called Linda Ezekiel received an International Society of Nephrology (ISN) fellowship in South Africa. Upon her return home, she managed to convince Baxter Healthcare Corporation to support a pilot acute PD program for pregnant women and children with AKI – called the “Access to Care” project – in Tanzania, to be implemented at two of the four main hospitals in the country. Unfortunately, the program stumbled in bureaucratic debates, leading to the withdrawal of the Baxter grant and the program’s collapse even before it started.⁹

In 1987, Dr T.C. Ankrah, from Ghana, reported that acute PD and sporadic HD were provided for the treatment of AKI at Accra University. Afterwards, two doctors received training in the UK and South Africa as part of an international society of nephrology training programs. Nowadays, both acute and chronic dialysis are currently available at the Komfo Anokye Teaching Hospital in Kumasi and the Korre-Bu Teaching Hospital in Accra.⁹

3. CURRENT ERA

3.1. The current situation of dialysis therapy in sub-Saharan Africa

There are progressing steps towards the management of CKD in SSA; however, the burden of CKD continues to increase. Though the incidence of infection-related CKD may

be declining, the overall incidence of ESKD is escalating in parallel to the increasing rates of diabetes mellitus, hypertension, and obesity. In addition, access to dialysis for ESKD is limited by insufficient infrastructure and catastrophic out-of-pocket costs. Most patients remain undiagnosed, untreated, and die.¹⁴

There is no available information on dialysis services in other East African countries, although some activity may be taking off in Uganda. Two nephrologists are available in the countries of Benin, Mauritania, and Togo, and one in Cape Verde and Niger. Limited acute dialysis is provided at university hospitals in eight other countries in the West region. South Africa was instrumental in starting dialysis programs in neighbouring countries during the late 1990s, following its sociopolitical reform. As regards Central Africa, only acute dialysis is offered at a few of the large hospitals in the main cities.⁹ Maintenance dialysis programs were established in twelve SSA countries and out of them, there were five national dialysis programs.¹⁵ The situation changed over time, as other new countries introduced dialysis programs but other countries could not support the cost of these national programs. Some countries offer limited short-term dialysis, including transient treatment to bridge an episode of reduced kidney function, preparation for a transplant, or managing the patient until travelling abroad for further management.¹⁵

3.2. Challenges faced by dialysis treatment in sub-Saharan Africa

Access to dialysis for ESKD is influenced by several impediments, such as local health indexes, the high prevalence of undernutrition and chronic infections; low per capita gross domestic product; national expenditures on health and increase of these expenditures with incremental demand; availability and adequate training of health care providers; and literacy.¹⁵ Most patients remain undiagnosed, untreated, and die. Ashuntantang G. et al reported in their systematic review that more than 95% of all adults and children who could not access dialysis in SSA died and of those who accessed dialysis, 88% of adults with incident ESKD, 16% of adults with prevalent ESKD, and 36% of children with ESKD died.¹⁷

Globally, the cost of HD care ranges from \$100 to \$200, but in some SSA countries, it ranges from \$80 to \$160, \$130 to \$200, \$10 to \$120, \$50 to \$100, \$70 to \$110, and \$120 in South Africa, Uganda, Cameroon, Kenya, Ethiopia, and Nigeria, respectively. PD is still in its infancy in most SSA countries.⁶ Government provides financial support for patients on HD in some African countries such as South

Africa, Malawi, Sudan, Tanzania, and Nigeria, but not so in other countries; for example, a study conducted in Nigeria shows that <1% of patients can afford treatment for more than three months mainly because of financial constraints.⁵

The shortage of adequately trained personnel has always been a critical barrier to dialysis services in Africa. France takes the credit of independently providing physicians and nurses with training as part of free technical support in francophone countries such as Côte d'Ivoire (1980) and Senegal (2004). The International Society of Nephrology stepped in with an escalating impact since 1987 through its fellowship program, training 23–102 young physicians from 20 African countries in ten developed countries in North and South Africa and Egypt. The number of trainees sponsored by this initiative has multiplied eightfold in 20 years.¹⁷

Another problem is patients' non-adherence to treatment, including skipping dialysis sessions when feeling well, disregarding dietary constraints, and neglecting

interdialytic medications, thereby leading to poor dialysis outcomes.¹⁸

4. CONCLUSION

In conclusion, this review describes the history of dialysis in sub-Saharan Africa until now based on available information. It also discusses the challenges faced by different countries that hinder the progress of dialysis services in this region. To overcome these difficulties, we need a competent workforce, with commitment from the government to focus on training and retention of nephrologists and nephrology nurses and the development of policies and strategies to increase the number of RRT centres available to prepare for the potential need for RRT. Moreover, proper planning, multidisciplinary work with the different health authorities, media and stakeholders, and a good record system should be established to diagnose patients early while an accurate referral system needs to be implemented.

ΠΕΡΙΛΗΨΗ

Ένα ταξίδι στην ιστορία της εξωνεφρικής κάθαρσης στην υποσαχάρια Αφρική

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Η υποσαχάρια Αφρική είναι μια ετερογενής περιοχή με 47 χώρες, πληθυσμό σχεδόν ένα δισεκατομμύριο ανθρώπους και ένα ακαθάριστο εγχώριο προϊόν 1,7 τρισεκατομμυρίων το 2017. Η ανάπτυξη της εξωνεφρικής κάθαρσης στην Αφρική αντικατοπτρίζει τις τοπικές κοινωνικοπολιτικές συνθήκες. Μέχρι τη δεκαετία των 1970, η Αφρική ανέκαμπτε από μια μακρά περίοδο αποικιοκρατίας και πολιτικών αναταραχών, έτσι ώστε μόνο λίγες χώρες μπόρεσαν να ιδρύσουν κέντρα εξωνεφρικής κάθαρσης. (α) Η εποχή πριν τη δεκαετία του 1970: Η νότια Αφρική ήταν η πρώτη χώρα στην υποσαχάρια Αφρική στην οποία άρχισαν να διενεργούνται συνεδρίες αιμοκάθαρσης το 1957, από έναν γενικό ιατρό στο νοσοκομείο του Krugersdorp προκειμένου να θεραπεύσει 2 ασθενείς με οξεία νεφρική βλάβη. Στην Κένυα, η εφαρμογή οξείας αιμοκάθαρσης ξεκίνησε το 1961 από τον καθηγητή L.S. Otieno, ακολουθούμενη από την περιτοναϊκή κάθαρση δύο χρόνια αργότερα. Στη Νιγηρία, υπάρχει περιορισμένη δυνατότητα διενέργειας οξείας αιμοκάθαρσης στο Lagos από το 1965 και οξείας περιτοναϊκής κάθαρσης στο Ibadan από το 1967. Κέντρο χρόνιας αιμοκάθαρσης ιδρύθηκε αρχικά στο Lagos Teaching Hospital το 1981 από τον καθηγητή T.A. Odutola. Στο Σουδάν, η πρώτη διενέργεια αιμοκάθαρσης έγινε με την μορφή της κατ' οίκον αιμοκάθαρσης το 1968 και εποπτευόταν από τον κ. Osman Awadalla. (β) Η εποχή μετά τη δεκαετία του 1970: Στην Ακτή του Ελεφαντοστού, η πρώτη οξεία περιτοναϊκή κάθαρση διεξήχθη το 1974 στο Abidjan από τον καθηγητή Alain Bondurand για τη θεραπεία ασθενών με πανώλη και οξεία νεφρική ανεπάρκεια. Στη Ζιμπάμπουε, οι καθηγητές John Forbes και Janet Seggie εγκατέστησαν ένα μηχάνημα τεχνητού νεφρού για τη διενέργεια αιμοκάθαρσης στο κεντρικό νοσοκομείο Harare στις αρχές της δεκαετίας του 1970. Το μηχάνημα χρησιμοποιήθηκε περιστασιακά για τη θεραπεία ασθενών με οξεία νεφρική ανεπάρκεια μέχρι το 1980. Στην Αιθιοπία, η περιτοναϊκή κάθαρση και λιγότερο συχνά η αιμοκάθαρση άρχισαν να εφαρμόζονται στο Πανεπιστημιακό Νοσοκομείο της Αντίς Αμπέμπα το 1980 όπως αναφέρθηκε από τον Δρ Berhanu Habte για τη θεραπεία

της οξείας νεφρικής ανεπάρκειας. Στην Τανζανία, ο Δρ J.P. Miabaji ανέφερε ότι δύο μηχανήματα αιμοκάθαρσης ήταν διαθέσιμα στο Πανεπιστημιακό Νοσοκομείο του Dar-El-Salam στις αρχές του 1980, για να θεραπεύσουν την οξεία νεφρική ανεπάρκεια ή σημαντικούς ασθενείς με χρόνια νεφρική νόσο τελικού σταδίου και προγραμματισμένη νεφρική μεταμόσχευση στο εξωτερικό. Στην Γκάνα, η Δρ T.K. Ankrah προσέφερε οξεία περιτοναϊκή κάθαρση και περιστασιακά αιμοκάθαρση για την θεραπεία της οξείας νεφρικής βλάβης από το 1980. Στη συνέχεια και άλλες χώρες της υποσαχάριας Αφρικής άρχισαν να εγκαθιστούν μονάδες αιμοκάθαρσης. Ωστόσο, τα κέντρα αιμοκάθαρσης εξακολουθούν να είναι σπάνια στις περισσότερες χώρες λόγω του υψηλού κόστους και της έλλειψης εξειδικευμένου προσωπικού.

Λέξεις ευρητηρίου: Αιμοκάθαρση μαύρος πυρετός, Αιμοκάθαρση ONA, Αιμοκάθαρση στην υποσαχάρια Αφρική μετά το 1970, Αιμοκάθαρση στην υποσαχάρια Αφρική πριν το 1970, Κατ' οίκον αιμοκάθαρση Σουδάν

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