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Transplantation Model- Analytical Review: A Strategic Proposal and Moral Obligation

Issa Al Salmi^{1*}, Fatma Al Rahbi¹, Ehab Mohammed¹, Dawood Al Riyami², Salima Al Alawi¹ and Suad Hannawi³

¹The Renal Medicine Department, the Royal Hospital, Muscat, Oman

²Nephrology Unit, Medicine Department, SQUH, Muscat, Oman

³The Medicine Department, MOHAP, Dubai, UAE

Abstract

Chronic kidney disease is rising worldwide in parallel to that of non-communicable disease. Kidney transplantation is the gold standard of care. We aim to provide a model for Oman transplantation and its health system

This is a situational analysis of the incidence and prevalence of end-stage kidney disease in Oman. Also, we examined the transplantation trends and the health system. We review the local transplantation and the commercial transplantation. Further, we reviewed few transplantation models to provide some insight into Oman model of transplantation.

Oman facing a tsunami of end-stage kidney disease. Its one-off a few countries around the world where almost people with functioning kidney transplant equal number on hemodialysis. However, majority of kidney transplantation were procured commercially outside the country. Upon their return home, these patients receive their full management at tertiary hospital without any further difficulties or issues of concern.

Oman health system needs to further strengthen its health services. This requires a strong political lead with full logistic and financial incentives. Both citizens and residents need to receive the necessary health requirements for ESKD. Transplantation, both deceased and living donation, need to be improved with strong tie with World Health Organization and Istanbul Declaration rules adherence.

Introduction

Oman is the second largest country in the South East of Arabian Peninsula that has a total population of 3, 831 553. The burden of non-communicable diseases including chronic kidney disease is a serious health care issue in Oman. Almost 40,000 persons aged 40 years, or more were screened for chronic kidney disease (CKD) in a preliminary survey performed in 2009 throughout Oman [1-3]. Of the individuals screened, 0.9% had severe renal failure, with an estimated glomerular filtration rate of less than 30 ml/min/1.73 m²; 9% had moderate renal failure with estimated glomerular filtration rates between 30 and 59 ml/min/1.73 m²; and 29% had mild renal failure with estimated glomerular filtration rates of 60 to 90 ml/min/1.73 m² [3]. There is a gradual increase in the prevalence of end-stage kidney disease (ESKD) and outpatient's morbidity caused by CKD in Oman [3].

All citizens have easy and free access to health services all over the country [2,3]. At the beginning, the number of patients with ESKD was very small, and they were sent to India for dialysis and lived there for the rest of their lives. In 1983, those patients who were still living in India were brought back to Oman when the first dialysis unit was established. The number of patients was small, and a single dialysis unit was enough for all patients across the country. In addition, all services were provided for them, including transportation [2,3]. However, with the increasing number of patients and rising prevalence of citizens with ESKD, Ministry of Health built new units to cope with the rising number of patients. The location of new units was built in close proximity to the majority of patients in each area [3].

Statistics of the ESKD incidence showed that during 1983, there were 34 patients, and in 2015 there were 230 patients per total population. The incidence reported by the end of the year 2018 was 350 patients per country per annum. All 24 hemodialysis centres are fully operated 24 hours a day and many patients are only on twice weekly dialysis sessions [3]. Oman ESKD patients are very young compared to those in Europe or North America. DOPPS study has revealed that these patients despite being young have developed major morbidity and mortality. Hence, improvement of kidney transplant service is demanded.

If this high CKD incidence is to be followed by a rapid rate of progression, with short duration in each stage of CKD, it is probable that we are seeing only the tip of the iceberg of ESKD with RRT. The nature of the relationship between CKD and ESKD is multifaceted, and many risk factors interact in a complex way that may ultimately determine its incidence and prevalence and the progression toward

***Correspondence to:** Issa Al Salmi, MD, BA, BAO, Bch, MB (Trinity College), FRCPI, MRCP (UK), FRCP, MIPH, PhD (AUS), FASN (USA), The Royal Hospital, 23 July Street, P O Box 1331, code 111, Muscat, Oman, Tel: 968 92709000; Fax: 968 245 99966; ORCID: 0000-0002-3443-5972; Research ID: J-4622-2014; E-mail: isa@ausdoctors.net

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ESKD across various populations. However, based on our data showing the continuing large increase in the prevalence of treated ESKD in Oman, the picture looks grim, with a high prevalence of CKD at the present time [1-3].

We noticed an uncommon observation that the number of ESKD patients living with a kidney transplant is almost equal to the number of patients treated with hemodialysis. In Oman, which has exclusively a living-related kidney transplant donation program, this program contributes 22.7% of the kidney transplantations for all the ESKD patients living with a kidney transplant within Oman. This has been the result of commercial transplantation from various developing countries. Deceased donor programs contributed to only 1.3% of total transplanted cases in Oman. However, 76% of kidney transplant cases are commercial transplantations that are being done abroad. This illegal pathway has led to an almost equal number of transplant cases and hemodialysis cases in the country. This has been driven by various socioeconomic and cultural beliefs. This manuscript aims to review several transplantation models and provide an insight for Oman to overcome its organ shortage and transplantation need and curtail transplant tourism [3-5].

Method

We reviewed Saudi Arabia, Israel, Iran, Pakistan and United State transplantation system or model and their history. We elaborated the situation of the transplantation program. Then, we discuss the issues and concerns of transplantations in Oman. Later on, we provided an insight into taken to achieve a reasonable success. At the end, we proposed a comprehensive transplantation model program for Oman to improve the care of people inside the country and curtail the transplant tourism from neighboring countries.

Organ Transplant Models- worldwide

Saudi Arabia Model

In Saudi Arabia (SA), transplant centers are performing both living related and deceased kidney transplantation. However, living-unrelated kidney transplantations is prohibited.

The first Living related kidney transplant was done in 1979 [6], and the first deceased kidney transplant was in 1981 which started as Euro-transplant. During this period of time, SA hospitals were receiving kidneys from Europe where it was been rejected due to various reasons such as anatomical abnormalities, prolong ischemia time or unacceptability for the transplant. So, these kidneys were suboptimal in their functions. The nephrologists worked as coordinator to find the recipients for those kidneys.

During the same period, they worked very hard to obtain religious approval (Fatwa) [6], for cadaveric transplant which was approved in 1982 [6].

For cadaveric transplantations, national kidney foundation was established in 1985. One of its main function was to establish the transplant waiting list where all patients with ESKD were registered and to organize the kidneys from cadaveric kidney transplantation. Later, the foundation was renamed as Saudi Center of Organ Transplantations (SCOT) when other organs like heart, lungs, livers and cornea were utilized for transplantations [6,7].

There were regional coordination offices in all major hospitals throughout SA, which are working under SCOT. The function of these offices is to identify cases with brain death from emergency rooms and ICUs and obtain consent for donation [6,7].

The kidney allocated to national patients whenever a suitable patient is available. If there are no suitable national patients, and after obtaining consent, the kidney may be transplanted to a non-national patient with priority for residents followed by visitors. Moreover, kidneys could be exchanged with other countries according to an agreement established between the SCOT and similar institutions in other Gulf countries [8].

It was noted that the numbers of identified brain-dead patients are more than the consent obtained from families. Patients are going for commercial kidney transplantations and come with complications that needed to be managed. For which, media and religious leaders through SCOT play a major role in educating the society and make them aware about the diseased kidney program and hence, the kidney donation increased since 1990 and onward [6,7]. In addition, the unlimited governmental support of all transplantation activities, e.g., cadaveric donor's families are offered financial support and free transportation of the donor's body to their country of origin in the case of expatriates [6,7].

For the living kidney transplantations, the donor should be blood-related or must be the breast-feeding mother and that must be confirmed by official specialized institutions. And emotionally related and non-directed non-commercial donation can be accepted. SCOT is a distinguished model for the region and especially the GCC, where there are very close similarities between such countries such as patients demography and health systems [8-10].

United State Model

Living related, living unrelated and diseased kidney transplantations are conducted in USA to help patients with ESKD.

There are multiple kidney transplantations centers in USA and each center has its own criteria for kidney transplantations. Moreover, not all centers doing all the type of transplantations [11-13]. It is the duty of the patient to choose the center of kidney transplantations for which patient should consider the following:

- 1- Insurance and cost
- 2- Location of the transplant center to ease to access
- 3- If patient has living donor, he needs to make sure that center is doing Living kidney transplant.
- 4- Centers is doing kidney paired exchange program.

In 1950s, each center was working alone and if the kidneys from cadaver transplant does not match for any patient from that center, it will be discarded. Hence, United Network for organ sharing (UNOS) was established in 1984 and all patients who are waiting for kidney transplantations will be registered and diseased kidneys will be organized and distributed equally among all centers.

Patients can be register in the waiting list once they started to have eGFR <20 and on dialysis. Initially the program was accepting diseased kidney and living related kidney transplantation. But between 1998 and 2008, it was noted that the numbers of patients in waiting list are increasing in comparison to available kidney donors and there was a significant reduction in the number of living related donors since 2003 [14,15]. Also, aging transplant candidate population and concurrent medical unsuitability of prospective donors as well as financial disincentives [12,15,16]. Moreover, the concerns of the nephrologists that most donors lost follow-up after 1-year post-kidney donation.

Because the outcome of living kidney transplantation was better than deceased donor, the following actions were taken:

1. The establishment of kidney paired donation (KPD) programs, in this system living donors who are incompatible with their intended recipients either because of ABO incompatibility or because of sensitization (leading to a positive cross-match) participate in a “donor pool,” resulting in an expanded availability of organs.
2. Permission of a non-directed live kidney donor (sometimes referred to as altruistic donors). These individuals offer to donate a kidney, but do not identify the specific recipient [2-4].

In regards of increasing the diseased kidneys, it was thought to increase diseased transplantation by using donors at extremes of age, double kidney transplants from marginal donors and extended-criteria donors [12,14,17,18].

Israel Transplantation Model

Kidney transplantation has been available in Israel since the mid of 1960's. The first two kidney transplants, one from a living related donor and the second from a deceased donor, were performed at approximately the same time at two different hospitals. Afterwards, kidney transplantation began to be performed in several hospitals throughout the country, but the overall numbers remained small [19].

In 1994, The National Transplant Center was established as an Israeli governmental organization. The objectives of the organization were to: promote organ transplantation, maintain a central list of potential transplant candidates, and select recipients as organs become available as well as to provide guidelines for various functions, such as selection of patients and collection of data.

Despite of these efforts, the number of kidney transplantation remained less than 150 per year in the early 2005. As a result of this, many Israelis with kidney failure travelled to other countries for kidney transplantation. Organ trafficking led to sever legislation and sanctions based on the adoption of Istanbul declaration [20].

In 2008, The Israel Knesset enacted 2 laws [21,22], the 1st defined brain death and provided the criteria for diagnosis brain death [23], the 2nd law, the transplantation law, defined the conditions for performing transplants using deceased and live donors in Israel [24,25].

By these laws' direct payment to donors and reagents were regarded as illegal, remuneration for loss of income was permitted and regulated and the regulations regarding the requirements for the use of organs from living donors were published [24,25].

The attitude of Jewish religious leaders regarding organ transplantation: Historically, many, but not all, rabbinic authorities rejected the use of organs from deceased donors for transplantation [23,26,27]. The main objection was related to the definition of brain death, which is not considered acceptable to many rabbinical authorities, as opposed to cardiac death, which was universally accepted [19,22,25].

Matnat Chaim encourages live kidney donation among Orthodox Jews in Israel: A non- profit organization, Matnat Chaim (“Gift of life” in Hebrew), a faith-based initiative, has emerged as a major force for organizing Living Donor Kidney Transplantation mainly by facilitating altruistic living un-related transplantation with an emphasis on donors from the Orthodox Jewish community through:

- A- Increase the awareness in the media, both traditional media, such as newspapers, magazines, radio and television, as well as new media, such as internet and social media sites, especially Facebook.

- B- The organization produces magazine supplements that disseminate stories describing the life and suffering of dialysis patients, as well as inspiring stories of kidney donors.

- C- Group meeting.

The organization helps donors navigate the health system and refers them to the Physician with particular experience in advising kidney donors. The organization does not interfere with matching or donor selection.

Related donors are required to receive the approval of an independent committee in the hospital of transplant center whereas altruistic non-related donors are referred to an independent national committee.

Potential donors can choose specific characteristics of the recipient like a child, a mother of small children, a non-smoker or a member of a specific religious group. But donors are not permitted to choose a specific recipient [19,22,25].

Matnat Chaim organization effects: The total number of live kidney donation facilitated by Matnat Chaim since its founding in February 2009 until the end of 2017 was 494. The mean age of these kidney donors was 41 years (range between 23 and 66 years), 73% were male and 27% were female. In 2011, only 27% of live donors were referred by Matnat Chaim whereas by 2016 it has increased to 55% (Figure 1) [19].

Through Matnat Chaim organization, the number of deceased donors had increased from a maximum of 87 until 2010 to 117 in 2013 and 115 in 2016. Also, the number of live kidney donor increased from 78 in 2010 to 222 in 2016. Matnat Chaim facilitated 4 live donor kidney transplantation in 2009, 11 in 2010, 32 in 2011, 37 in 2012, 33 in 2013, 49 in 2014, 89 in 2015, 127 in 2016 and 112 live donor kidney transplants in 2017 [19].

The increase in the number of transplants has resulted in a plateau in the number of patients on the transplant waiting list [19,22,27].

Iranian Model of Transplantation Model

The first kidney transplant in Iran was done in 1967, it was the first organ transplant in the Middle East Society for Organ Transplantation. In 1988, because of the long waiting list, the Iranian Ministry of Health for kidney transplant, regulated living-unrelated donor kidney transplant program was approved [28]. In addition, in 1989, a religious approval (fatwa) from the Supreme Religious Leader was achieved that recognized brain death and allowed deceased-donor organ transplant [29].

By 1999, the kidney transplant waiting list in Iran was eliminated. Subsequently, transplant centers created performing deceased-donor kidney, liver, and heart transplants [30].

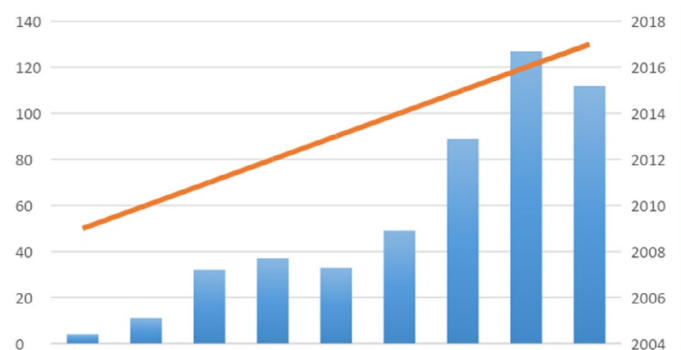


Figure 1. Shows the Matnat Chaim facilitation of 4 live donor kidney transplantation in 2009, 11 in 2010, 32 in 2011, 37 in 2012, 33 in 2013, 49 in 2014, 89 in 2015, 127 in 2016 and 112 live donor kidney transplants in 2017

In 2000, the Brain Death and Organ Transplantation Act was approved by the Iranian parliament, legalizing deceased-donor organ transplant. The transplant team at Shiraz began performing more deceased-donor kidney and liver transplants and became a fruitful deceased-donor organ transplant model in the country [28-31].

In 2011 and 2012, Iran was ahead of all country members of the Middle East Society for Organ Transplantation in performing deceased-donor kidney and liver transplants [31] and graded as number 33 among the 50 most active countries worldwide.

By the end of 2012, there were 34166 kidney (including 4436 deceased-donor) and 2021 liver (including 1788 deceased-donor), 482 heart, 147 pancreas, 63 lungs, and several intestine and multi-organ transplants performed in Iran.

Organ Transplantation in Iran before and after 2008 Istanbul Declaration

In 1979, the period previous to the revolution, random transplanted cases were done, but despite the high expenditures and cultural and language barrier, most of the 114 transplantations performed in this period, were carried out abroad, especially in the United Kingdom, were using imported organs from Euro transplant organ sharing network with large payment. The limited kidney transplantation activities were totally stopped two years after revolution and the expertise transplantation surgeons left the country [32,33].

In 1984 and despite the grim circumstances, the first kidney transplantation after a temporary stop, was carried out in Tehran with minimal facilities and support, but excellent outcome [34]. The organ was donated by a brother to his sister. Fifty such transplants, all from live related donors, were carried out in various setups.

This eventually led to the expansion of the National plan for kidney transplantation, which was officially well-known in a hospital devoted to nephrology and urology patients. The hospital was university-affiliated, and a multidisciplinary team was assigned to manage and govern the program. The excellent success rate, low cost and remarkable outcome encouraged all patients to join the waiting list for transplantation [31,35-37].

To prevent transplant tourism, in 1992 the high council of organ transplantation in the Ministry of Health and Medical Education ruled the prevention of foreign nationals to be transplanted in Iran, except they present a live donor of their own nationality. Since April 2010, following Istanbul Declaration, and to respect its contents, kidney transplantation of foreign individuals was entirely removed from transplantation activities in Iran [37].

Despite the efforts to motivate and support deceased organ donation, still the large gap between available donors and demand, makes the unrelated donation an alternative. To support the donors and recipients, a state-regulated system was started, and a recompense was offered to the volunteer donors following the donation service. Though this reward was satisfactory at the beginning, but year by year it slowly lost its real worth due to rise each year and situation evolved to present day, where the additional demand is compensated by the recipients [38].

However, The Bioethics Committee of the Academy of Medical Sciences of IR Iran confirmed that the act of kidney donation from living related and unrelated volunteers is generally acceptable, and offering a reward as appreciation, gift or compensation is not considered unethical and should not discourage this honorable act provided. Various strategies of Iranian model to solve the dilemma of sale vs. donation is shown Table 1.

<p>Legal approval of compensation for donor and transplantation expense in the hospital</p> <ul style="list-style-type: none"> • Saving lives of many ESKD patients especially before the Brain Death Act • Waiting list omission • Complete medical and psychological examination of donors in the hospital, in addition to routine outpatient evaluation process • No middleman/broker or travel to the country to buy kidneys • No financial benefit of transplantation team • Development of BDD program and its progression (increasing experience of transplantation centers)
<p>Same nationality of donor/recipient:</p> <ul style="list-style-type: none"> • Donors cannot seek the highest possible price (no foreign patient can enter the system) • Rich and poor can be transplanted
<p>Supervision of Patients' Foundation on donor motivation:</p> <ul style="list-style-type: none"> • Getting informed written consent from donor and next of kin • No coercion of donors • No exploitation of the poor • Donor age 18 • Separation of scientific responsibilities from ethical ones • Protection of fundamental doctor-patient relationship
<p>Transplantation centers in academic hospitals licensed by the MOHME:</p> <ul style="list-style-type: none"> • Decrease donor harm to the least • Development of newer and safer approaches possible (e.g., laparoscopic nephrectomy) • Complete medical and psychological examination
<p>Supervision of Patients' Foundation on donor motivation:</p> <ul style="list-style-type: none"> • Direct financial connection between donor/recipient (negative point) • Donors do not like to be known (negative point) • Transparency of system (no abuse in the system) • Development of BDD program and its progression (by redirection of the budget) • Lack of protracted/long-term follow-up of donors

Table 1. Shows various strategies of the Iranian model to solve the dilemma of sale vs. donation

Pakistan Model of Transplantation Model

Kidney transplantation in Pakistan began in 1979 from living related donors in public sector hospitals. The activity was as low as less than 50 cases per year but slowly rose to more than 100 per year by the mid-1990s [40].

Shortage of donors for lack of a deceased donor program along with rapidly developing skill in transplantation principal to unrelated commercial transplants in the private sector where the poor were exploited to donate kidneys for US\$ 1000 to 2000 [40,41].

By the year 2000, the number of transplants per year exceeded 1000—more than 70% of which were unrelated commercial donors [42].

Although, most of the recipients were local, which led Pakistan to become the largest center of transplant tourism by the year 2005—where almost 1500 foreigners received transplants every year in private sector hospitals [42].

By the year 2007, of 2500 transplants performed annually in Pakistan, 2000 were unrelated commercial transplants, 1500 of which were for foreigners. Of the 500 living related transplants, 50% were performed in one center in Karachi, southern Pakistan [42].

Dialysis and transplantation service were available for few select people who could afford it with >90% of population disfranchised [40-42]. This situation made transplantation irrelevant to the common people and consequently for it to gain ground as a successful management, it had to be made available to this population and thereafter the society could be asked to support transplantation, declaration of law and organ donation from living and deceased [42].

A single institute in Karachi started a combined dialysis and transplant program. In addition, all services were offered free of charge to all patients to include recipient and donor follow-up and post-transplant immunosuppressive drugs. This program was based on a philosophy of public-government partnerships with the public donating up to 60%–70% and the government the rest [42-44].

Excellent results of the Institute established reliability overseas and led to the first cadaver kidney transplant in Pakistan by the courtesy of Euro-transplant Foundation [42]. After transplantation of 26 deceased donor kidneys from Euro-transplant becomes the first resident deceased donor in 1998 followed by another in 2005.

The Transplant Law in Pakistan in 2010: *The beak on transplantation was accessible in the legislature almost 15 years ago in the early 90s. It remained inactive for the first decade in numerous specialist committees from government to government mainly due to non-acceptance of transplantation by the society as a therapeutic modality due to social, cultural and religious concerns [42]. This lack of facilities in the presence of skill moved transplantation in the private sector largely depended on living related donation. SIUT, however, established itself as the best transplant institution in the country, started a campaign against organ sale and transplant tourism [40,42,44].*

Feature of the Transplant Ordinance in Pakistan: The transplant rules excluded commercial unrelated transplantation of locals as well as foreigners. It allowed donation only from living donors who are first degree relatives and legally related. But in case of unavailability of donor, a “non-first degree relative” can donate after getting approval by an assessment committee. In addition, the regulation permitted donation from “brain death” donors who gave consent in life to be donors or with the consent of their head of kin [40,42,44-46].

Finally, punishment for breaking the ordinance was 10 years custody and a fine of US\$ 15,000 [41,42].

Discussion

There is no perfect system or model of transplantation worldwide. However, the IR of Iran Transplantation Model seems the most suitable model in the region and world-wide. Oman may need to adopt such a model if to be successful in its provision of necessary transplantation care for various end-stage organ failure. Treatment of patients with ESKD is one of the major health care challenges in Oman, as the number of ESKD patients is continuously increasing. The prevalence of patients receiving RRT at the end of 2013 was 2382 with an incidence of 120 per million population, and it was more frequent in young patients, as 86% of them were of 64 years and below. The prevalence and incidence of treated ESKD patients reported in 2013 in different Asian and Middle East countries with some similarities in the geographic and socioeconomic patterns as in Oman. These countries have prevalence rates of treated ESKD patients ranging between 200 and 3000 patients per million population. As well as an increase in ESKD prevalence, as expected, a gradual increase in the outpatient morbidity caused by CKD has been observed. In 2014, for example, a total of 1280 males and 3150 females per 100 000 population had evidence of kidney or urinary tract disease. Additionally, surgical procedures related to the kidney and urinary tract constitutes a considerable economic burden [1-3].

Transplant regulations were established in Oman in 1994 and were supported by formal ministerial decision. The brain death criteria have been accepted by civil authorities and religious authorities but have not yet been accepted by the public at large, possibly due to poor educational programs and media advertisements. As the deceased donor program is still in its infancy, we anticipate that it will increase and hence curtail the use of commercial transplantations. Implementing comprehensive central strategies to consolidate the living related donor kidney transplantation and supporting kidney organ donation is the way forward in treating people with ESKD [3,4].

A survey was carried out in 2010 to evaluate the attitude of our population toward organ transplantation and the results showed great public acceptance of kidney donation during life and very low acceptance of after death donation. Religious and sociocultural factors have to be further addressed and regulations and laws have to be strengthened to further improve the service and to curtail organs commercialism practices.

Although Oman deceased donor transplants program was among the earlier programs in the Gulf region, it was not fully sustainable, and the transplantation program turns now to be mainly living related donor transplants program. The absence of resources to establish a committed organizational unit for deceased donor transplants was the major challenge causing its unsustainability compared to neighboring countries. The program requires a good network of donors' coordinators throughout all intensive care units. Similarly, the absence of kidney support societies is an important hurdle that the government must tackle and to ease the establishment of such important public services to further improve the care of people with ESKD. The disturbing effects caused by unregulated commercial transplants performed outside the country, which is called transplant tourism, contributed to some extent to the unsustainability of this program. Interestingly, the support of the Declaration of Istanbul, in which the ethical guidelines and framework for transplantation was established, had led to immediate decrease in commercial transplants and a noticed increase in the number of transplants performed in Oman during the period of 2007 to 2009

(from 12 to 23 operations) [3,4]. However, in recent years, there is an increasing trend towards commercial transplantation, especially from Pakistan and China, as well as countries that suffer from political unrest and natural disasters, where the poor being targeted for their organs in exchange for a financial gain.

Previously, we reported that Oman has exclusively a living-related kidney transplant donation program, but this program contributes 22.7% of the kidney transplantations for all the ESKD patients living with a kidney transplant. This has been the result of commercial transplantation from various developing countries. Deceased donor programs contributed to only 1.3% of total transplanted cases in Oman [3]. However, 76% of kidney transplant cases are commercial transplantations that are being done abroad. A recent paper found that 3% of their participants paid only \$15,000 to \$30,000, 33% paid between \$30,000 and 45,000, and 52% of the participants stated that they had paid more than \$45,000 for KT; 65% of them had paid before the operation and after the agreement was made with the broker on the price for the obtained kidney [4].

The brain death concept is still distant in the Omani public. The meaning is that an individual is dead, according to medical definition, while the heart is still beating causing a lot of confusion between the patient's career and the caring doctor. This misunderstanding of the concept of brain death avoids the use of these individuals as potential organ donors, which is a problem in an era where the needs for organs exceeds their availability.

In Oman, despite the permission from religious and legal authorities to use organs from deceased donors we are now practicing almost solely with living related donors. The public attitude toward donation is essential in all transplantation programs. Furthermore, a survey was carried out in 2010 to assess Omani populations' attitude towards organ transplantation, showed great public acceptance of kidney donation during life and very low acceptance of after death donation. However, religious and sociocultural factors have to be further investigated and regulations and laws have to be strengthened to further expand the facility and to prohibit organs commercialism action [4].

A common thread that binds all faiths of the world is that the saving of life overrides all objections, and no religion is against organ donation. In KSA and Kuwait, have successful kidney transplantation programs, which might notify the kidney transplantation program in Oman to assume some variations to the present system to make the program more active. However, the MOH has provided all the resources for successful kidney transplantation program in Oman such as the transplant coordination unit and kidney donor clinic [1,3-5].

Oman, similar to countries in the regions, and various other countries around the world must empower their citizens, provide the care required to improve their lives, and preserve dignity and human values. Efforts must therefore be directed towards strengthening the national program with full logistic, financial, and strong legislation to protect human lives locally, regionally, and globally and must collaborate with international efforts to combat organ trafficking and commercialism and to encourage the notion of humanity's best interest [3,4].

Though Oman deceased donor transplants program was among the earlier programs in the Gulf region, it was not fully supportable, and the transplantation program turns now to be mainly living related donor transplants program. The major challenge causing the unsuitability of this program in Oman compared to the neighboring countries was the

absence of resources. The brain death criteria have been accepted by civil authorities and religious authorities but have not yet accepted by the public at large, possibly due to poor awareness programs and media announcements [3,4].

A clear guideline related to the diagnosis of brain death and subsequently guidelines related to the withdrawal of life support in these patients and been approved by the primary health services. However, we as health care professionals and physicians have failed to bridge the gap that exists between medical knowledge, legality of brain death, religious views, and the education of our community in this regard [3,4].

In order to resolve this, different institutions, most importantly RH and SQUH, across the country need to come together to form a committee in order to deal with this important and critical subject. Secondly, we need to arrange and conduct a forum, including religious and legal authorities, to discuss organ donation and come to a consensus on policies and guidelines relating to the process of organ donation. Finally, we also need to educate the public on sensitive issues such as this and increase their overall awareness of brain death as a medical condition. Religion plays an important part in the public live of the population and hence a proactive religious approach is needed at a regular pace to inform our citizens especially during the Friday prayers where thousands of people attend it on a weekly basis. Media must do a similar task as well to better approach young people and educate them of the importance of organ donation.

In Oman, the decision to donate organs is a crucial step in the process of transplantation. Moreover, Arab countries have poor transplant rates because of multi factors. Which might include, have low levels of infrastructure, an inadequate trained professional staff lack of a legal structure leading the brain death program, religious, cultural and social constraints, patient anxiety, physician bias, commercial encouragements that favor dialysis and geographical remoteness. It is based on personal or familial opinions that are strongly influence by many factors, including education, socioeconomic status, religion and cultural characteristics [3,4].

Al Alawi, *et al.* stated that the DD program needs a good network of donors' coordinators all over intensive care units [1,2]. In the same way, the absence of kidney association support is an important obstacle that the government must challenge and to comfort the launch of such important public services to improve the care of people with [1,3,4].

In addition to deceased program, Oman will need a few parallel strategies for a successful organ transplantation, the full support of live organ transplantation, both related and non-related. These pathways require logistic and financial support of both government and NGO. Presently, Oman uses, through its patients, other countries citizens to provide organ, i.e. commercial transplantation. This need to stop! Legally and ethically, it is unacceptable to continue with such an act in the twenty first century. If at all, there is a need to utilize live unrelated, then it must stay within the country and no need to cross borders to other countries. Morally, if there is a need for live unrelated, then every country could provide some strategy to have a fair and acceptable system within the community to enable such a strategy. Any citizen individual willing to be live unrelated kidney donor would be registered in a general donor pool and may avail for a financial compensation of 15,000-20,000 OMR. In addition, the donor is also would be provided with follow up medical care for the rest of his live. The donation cannot be specified to individual, but it would be in a general pool of donor. This would ensure a fair and equitable system where the general criteria

for recipient is utilized in this pool. Recipient need to wait for at least a year to avail for such a service.

Hence, these three major strategies, deceased, living related and living unrelated, would be able to overcome shortage of organs (kidney) in the country. Importantly, it would curtail the transplant tourism and ameliorate all the suffering of its endeavor. However, only time and experience shall prove its success or failure [1,3,4].

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