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REVIEW

Rheumatology in Egypt: back to the future

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Abstract

Medical knowledge in ancient Egypt had a remarkable reputation since rulers of other empires used to request the pharaoh to send them their best physician to treat their beloved ones. Many rheumatologic conditions as giant-cell arteritis, reactive arthritis and other forms of spondyloarthritis have been identified in ancient Egyptian materials. Rheumatologists in Egypt are enormously expanding and mastering the tools that aid them in enhancing the management of rheumatic diseases. More Egyptian rheumatologists are actively participating in the annual European League Against Rheumatism (EULAR) and American College of Rheumatology conferences and those attached to well known state of the art centers are increasing. EULAR certified Egyptian MSUS trainers are effectively performing regionally. This review throws light on the rheumatology practice in Egypt, its progress from ancient times passing through Egyptian medical healthcare services, education systems for rheumatologists, rheumatology associations, an overview on the spectrum of rheumatic diseases through publications in the field till future perspectives. Rheumatology in Egypt is an actively growing and dynamic specialty of medicine with considerable contributions to the world's literature. These days, persistent efforts are mandatory to raise the standard of clinical and basic research, to optimize clinical practice with regard to new biologics, to develop tailored and targeted therapies for the rheumatic diseases, and to meet the medical demands of the exponentially increasing Egyptian population. Opportunities and challenges discussed high-lighten future perspectives needed to boost the rheumatology practice in Egypt.

Keywords Egypt · Rheumatology · Rheumatologists · Practice · Research

Introduction

Egypt (Misr), the oldest civilization has long been known for its leading influence on medical practice including the diagnosis and treatment of rheumatic diseases documented on the hieroglyphic paintings of the temples and monuments walls [1]. Ankylosing spondylitis (AS) was long believed to be a disease that occurred in ancient Egyptians, based on its diagnosis using X-rays of the mummies dated to 18th–19th dynasties [2]. More recently it has been proposed that Amenhotep III and three other pharaohs were misdiagnosed and had diffuse idiopathic skeletal hyperostosis (DISH). The new findings are based on an examination of more detailed CT scans of the mummies of 13 Egyptian pharaohs and queens who lived between 1492 and 1153 before the common era (BCE) [3]. Egyptians first identified gout, known as podagra, in 2640 BC and Ancient Egyptians used willow extract to reduce the redness and pain of inflamed joints [4]. Osteoarthritis stigmata, found in nearly every period and civilization, were evident in the Egyptian mummies [5]. Interestingly, rheumatic diseases were described in traditional Chinese medicine 2000 years ago [6]. Similarly, in India the spectrum of rheumatic diseases poses a challenge for clinicians and rheumatology is an emerging specialty [7]. In Slovenia, a central European country, there is a wide breadth of clinical and scientific endeavor in rheumatology; whilst there is still more to be done; the emergence of early interventional clinics is beginning to yield dividends with the achievements of an early diagnosis and timely commencement of treatment [8]. Alike, Egypt is striving to get a higher standard of rheumatology care and education as in more developed countries. A model to follow is the modern initiative of the European League Against Rheumatism (EULAR) school of rheumatology to catalyze the development of the

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undergraduate rheumatology curriculum in medical schools across Europe [9].

The frequency and pattern of rheumatic diseases in India and Pakistan are in accordance to those in western countries. However, the available services and treatments were invisible or inadequate during the last century and most patients would seek non-traditional approaches and complementary medicine [10]. Despite the fact that rheumatologic disorders affect 6–24% of the population, rheumatology in India is still in its infancy [11]. Higher rates of musculoskeletal complaints are reported from Iran above 40% in urban and 60% in rural areas [12]. Different from the current situation in Egypt and economic burdens, Korea's rapidly growing economy and high education level enabled rheumatology to take giant progressive steps raising the standard of clinical and basic research to optimize clinical practice with regard to new biologic agents, to develop personalized and targeted therapies and to meet the medical demands of Korea's ageing society [13]. On the contrary, rheumatology services are negligible in Zambia with an urgent need to build capacity for these facilities to improve the care and management of rheumatic diseases; supported by the International League of Associations for Rheumatology (ILAR) a short term project at their University Teaching Hospital provided substantial progress with streamlining of rheumatology patients, laying foundations for continuous medical education (CME) in rheumatology and raising public awareness of rheumatic diseases [14]. When comparing the previous different journeys of rheumatology in many countries, there remains a gap with the evolution of the practice in the UK which started in the early 1950s in close association with physical medicine and later with general medicine due to the rising awareness of the overlap of rheumatic diseases [15]. It is important to understand the international situation of rheumatology to be able to address the strengths and barriers in Egyptian rheumatology and to identify the opportunities and challenges that Egyptian rheumatologists may face. This review addresses some challenges, records some of the current initiatives and progress, and identifies opportunities for further development of rheumatology in Egypt.

Search strategy

This review was conducted according to the writing narrative biomedical literature guidelines [16]. The database Scopus and Medline were searched and limited to the country 'Egypt' with no date restriction. The article titles, abstracts, keywords and full text (when possible) were revised for the search terms: "rheumatology, osteoarthritis, rheumatoid arthritis, seronegative spondyloarthritis, systemic lupus erythematosus, systemic sclerosis, idiopathic inflammatory myositis, osteoporosis, vasculitis, Behçet's disease, gout, juvenile rheumatic disease, Sjögren's syndrome, fibromyalgia syndrome, periodic syndromes and biologics". Articles with relatively large number of patients were identified according to prior authors' knowledge and advanced search.

Egyptian medical and healthcare services

The population in Egypt, now exceeding 100 million is expected to reach 150 million by 2050 with an emerging demand for more healthcare services. Moreover, the majority of the population is youth and those above 40 years—with enhanced need for medical care and long term rehabilitation facilities—are expected to double approaching 60 million. Almost half the Egyptians are medically insured by the ministry of health (MOH) with an expanding private insurance service and a newly implemented law aiming to widen the spectrum of the medical insurance coverage [17]. Egypt has a highly pluralistic healthcare system with varied public managements, private providers and financing agents in the various sectors of the government including university, teaching and MOH hospitals at variable levels of intervention [18]. The burden of the growing population and limited resources signify that Egypt still faces notable disease control issues [19]; thus private medical establishments are now encouraged to lead in providing the services [17].

Although Egypt is well-positioned as a top touristic destination, medical tourism is lagging [20]. However, it is a famous regional target for its well known outstanding reputation of physicians, variety of services at reasonable prices in addition to the easy regulations for foreigners to attain a visa mostly from the Middle East and North Africa (MENA) [17]. The well developed tourism infrastructure, abundance of healthcare professionals and the great geographical location make Egypt an important aim for medical tourism. Obvious drawbacks include the absence of medical tourism governance, poor marketing, unstable quality of healthcare services, and absence of educational programs promoting the service providers to handle this category of tourists [20].

The route towards becoming a rheumatologist

In Egypt, it takes 7 years, after secondary education to graduate from a medical school followed by a 1 year rotation as a house officer in various medical and/or surgical departments. Thereafter, becoming a rheumatologist is currently possible as a subspecialty of internal medicine with in-depth study of rheumatic diseases and clinical immunology provided by 18 governmental universities; newly emerging ones are on way. Compared to other countries of similar challenges, rheumatologists in India are accredited from 11 recognized

institutions although their population is more than 10 times the Egyptians while in Pakistan, almost a quarter of the established rheumatologists have emerged from four recognized centers [10]. In another regional country, rheumatology in Iran started in the 1960s and is recognized as an internal medicine subspecialty in 37 medical universities [12]. In Egypt, studying is in English language with no unified national examination, making the ongoing attempts to unify a rheumatology board certification necessary. There are three routes for a rheumatologist to be certified; universities provide a degree in rheumatology and rehabilitation as a subspecialty of medicine or via specialized units of internal medicine or pediatrics. In China, the residency training of graduates in internal medicine involves a 3-year rotation through eight subspecialties including rheumatology calling for a need for CME [6]. In line with the need to improve internal medicine resident's skills and self-confidence in rheumatology, more potential curricular advances are required [21]. A variable number of the rheumatologists in Egypt potentially participate in the annual EULAR and American College of Rheumatology (ACR) conferences and activities while others receive their training attached to well known state of the art centers. In accordance, the training of rheumatologists now working in India and Pakistan has in the past been heavily reliant on training opportunities in the UK and USA [10]. The take off of rheumatology as a distinct clinical specialty in Korea was at a parallel stage to other specialties. Young professors trained in the USA on their return contributed substantially to advances in rheumatology clinical practice, educational programs and research activities [13].

Rheumatologists in Egypt

The strength and in-depth of rheumatology practice in Egypt and focused interest in managing certain rheumatic diseases differs from one centre of excellence to another. The majority of Egyptian rheumatologists hold a postgraduate degree and effectively deal with the spectrum of presenting disorders involving regional pains, fibromyalgia, osteoarthritis, osteoporosis, rheumatoid arthritis, seronegative spondyloarthritis, crystal-associated arthritis, arthritis associated with systemic diseases or infection, vasculitis and connective tissue diseases as well as many other rheumatic diseases. Rheumatologists in Egypt are enormously expanding and mastering the tools that aid them in enhancing the management of the diseases. In line with the international recognition and awareness of the importance of musculoskeletal ultrasound (MSUS) in potentially establishing or confirming the diagnosis and in improving the accuracy of interventional joint injections, the EULAR certified Egyptian trainers are effectively performing and form a regional platform for MSUS training.

As in many other countries, there is an increasing shortage of rheumatologists per population; to-date there is around 3000 specialized in rheumatology (3/100,000 population) with perhaps less than half effectively practicing and many working in surrounding regional countries. Moreover, the distribution of rheumatologists is uneven over the country being concentrated and focused in the capital and main cities. In accordance, such uprising problem is extensively investigated even in advanced countries including the USA and Canada. It has long been warned about the upcoming shortage in rheumatologists in spite the advances in the treatment options allowing tight control of rheumatic diseases [22]. This predicted deficiency of practicing rheumatologists urgently called for implementing plans for physician retention [23]. There are many rheumatologists in Egypt that may need extra experience and training. Compared to other developing countries, despite the growth of the specialty in South Asia, the number of rheumatologists remains pitifully small. In India there are 100 recognized rheumatologists and in Pakistan there are only 20 [10]. Again, in China the number of rheumatologist per population is considerably less than in Western countries [6]. In 2012, the number of rheumatologists in China was 4500; most of them were aged < 40 years and almost half have postgraduate degrees. Increased awareness in developed countries focused on the ongoing shortage of rheumatologists necessitating the efforts to encourage trainees to enter rheumatology and approaches to aid retention. Full-time rheumatologists were estimated to be around 1/100,000 population with a 25% deficit to meet recommendations of the Canadian rheumatology association [24]. For more than a decade, adult practicing rheumatologists in the USA were roughly 1.7/100,000 persons. However, the aging population and demand for service were disproportionate with the growth in number of rheumatologists and an expected shortage climbing to 2500 by 2025. Adding to the problem, 90% are practicing in metropolitan regions while several areas have none. Such limitations may gravely boost joint damage, physical dysfunction and prevent remission as early diagnosis and treatment of rheumatic diseases is very important in the first few months of disease onset [25]. Interestingly, as rheumatology is facing workforce shortages, the ACR/ARHP rheumatology curriculum outline can be utilized to train nurse practitioners and physician assistants and create their more efficient integration into rheumatology practice [26]. Interestingly, implementing telemedicine pediatric rheumatology clinics saved time and cost and may prove to be potentially effective in raising the standard of rheumatology practice by consulting tertiary care centers of excellence and providing the patients with optimum treat to target care [27].

Spectrum of rheumatic diseases in Egypt

Many studies are conducted on Egyptian patients with rheumatic diseases; however, those involving large cohorts are limited.

Osteoarthritis (OA)

In a study on 200 Egyptian patients with knee osteoarthritis (KOA), the presence of knee effusion, Baker's cysts, osteophytes, and high body mass index had a great impact on the pain and disability. Higher clinical, radiographic and ultrasound scores correlated with the emergence of depression in those patients [28]. In another study on 160 KOA patients, a proposed ultrasound grading scale was in good agreement with the plain X-ray grading [29]. In a study on 180 KOA Egyptian patients, chondroprotectives were effective in improving symptoms with no cartilage sparing effect [30] while sustained release ibuprofen was effective and enhanced compliance [31]. In an elderly population study from Fayoum, the prevalence of OA was found to be 73.5% and the highest among all non-communicable diseases [32].

Rheumatoid arthritis (RA)

Reviewing ancient Egyptian medical writings disputed the claims that rheumatoid arthritis (RA) is a historical disease. In fact the suggested cases turned out to have osteoarthritis or spondyloarthritis; thus supporting the hypothesis of the New World origin and spread of RA [1]. Visual feedback has successfully enabled Egyptian RA patients to monitor a real-time change of their disease activity parameters as well as the patient's reported outcome measures [33]. In a retrospective study on 3219 Egyptian RA patients there was a 5.6:1 female to male ratio, a low frequency of extra-articular manifestations and erosions over time denoting an improved disease control [34]. Sleep disturbances were frequent in Egyptian RA patients [35] and depression was found in 15% and associated with worse health outcomes [36]. Interestingly, female Egyptian RA cases experienced more loneliness than Dutch patients [37] while male patients with early RA frequently had hypoandrogenicity [38]. There was a recent contribution from Egypt in the development of regional guidelines [39]. In a genome wide association study (GWAS), Cluster of differentiation 28 (CD28) rs1980422 and Protein tyrosine phosphatase, non-receptor type 22 (PTPN22) rs2476601 were found to contribute to RA-susceptibility in Egyptians [40].

Seronegative spondyloarthritis (SpA)

In the work on seronegative spondyloarthritis (SpA) from Mansoura city, the disease characteristics were comparable to those from other countries except for the lower prevalence of extra-articular manifestations. Ankylosing spondylitis (AS) was the most prevalent followed by psoriatic arthritis (PsA) [41]. Ankylosing spondylitis in Egypt is more prevalent than in Japan, probably because of genetic differences [42]. In a study conducted on 60 PsA Egyptian patients, a high frequency of subclinical atherosclerosis was present and dependent on serum uric acid level suggesting that chronic systemic inflammation and endothelial dysfunction appear to be the link between asymptomatic hyperuricemia and atherosclerosis [43]. An Egyptian knee enthesitis working group performed enhanced MRI studies and was able to detect subclinical synovitis and enthesitis in psoriatic patients [44] and to differentiate undifferentiated arthritis [45].

Systemic lupus erythematosus (SLE)

In an early attempt to study the clinical characteristics of 521 systemic lupus erythematosus (SLE) patients from the rheumatology department of Cairo University hospitals and from the private practice of the ex-president of the ILAR El-Hadidi T, the study was conducted by El-Hadidi KT Jr. with the contribution of Gheita [46] concluding that disease expression was not substantially different from the other ethnicities, yet with a lower incidence of neuropsychiatric involvement. Nationwide studies supported by the Egyptian College of Rheumatology (ECR) are on their way to better reflect the situation of SLE over the country.

In a work on 402 SLE Egyptian patients, pleuropulmonary involvement was the most frequent being found in 66% and pleurisy was the most common clinical finding followed by pulmonary infection [47]. In another study on 221 patients, positive anti-Ro was associated with a reduced high density lipoprotein which in turn increased the risk of cardiovascular accidents [48]. Ocular affection was frequent in Egyptian SLE patients with dry eyes and retinopathy being the most common findings while, anti-phospholipids, disease activity and duration were significantly related to eye affection especially retinopathy [49]. Amusingly, in a study on 94 Egyptian SLE patients from Sharkia—a large governorate in Egypt—it was found that all lupus quality of life (QoL) domains were reduced [50] adherence rate to medications in Egyptian SLE patients was quite low [51]. In a prospective study on 36 pregnant SLE patients, uterine artery Doppler seemed to be an earlier prognostic factor allowing antepartum intensive care, optimal timing of delivery and a good pregnancy outcome [52]. In a study from Upper Egypt, lupus patients were at an increased risk for avascular necrosis (AVN) found in 15% especially those on high dose corticosteroid [53]. In SLE cases admitted to the ICU in Fayoum, mortality increased especially in those

with high disease activity mostly due to infection, respiratory, cardiac and neurological complications [54].

Systemic sclerosis (SSc)

In a study on Egyptian patients with systemic sclerosis (SSc), almost all patients had antinuclear antibody (ANA) seropositivity, abnormal pulmonary function tests (PFTs) and abnormal nailfold capillaroscopy (NFC). Antitopoisomerase I antibody seropositivity, interstitial lung disease (ILD), abnormal PFT, worsening skin score, late pattern of NFC were more common in diffuse cutaneous subtype [55]. In pregnant Egyptian SSc cases, safe and healthy pregnancies are possible if planned when the disease is stable and is monitored by a multidisciplinary team [56].

Idiopathic inflammatory myositis (IIM)

Studies on IIM in Egypt are scarce. One epidemiological study from Upper Egypt revealed a lifetime prevalence of 11.5/100,000 population [57].

Osteoporosis

In a recent view point from the MENA region on the epidemiology and awareness of osteoporosis, osteopenia was prevalent in populations from Upper Egypt and osteoporosis was less common and increased in postmenopausal women from rural areas. Osteoporosis was found to be coined to the low socioeconomic women on oral contraceptive pills [58]. The prevalence of osteoporosis in Egypt was 21.9% in men and 28.4% in women [59]. The frequency was even more increased in Egyptian patients with RA and SSc compared to other rheumatic diseases [58]. In a study on 532 women aged ≥ 40 years living in Alexandria the knowledge of osteoporosis was moderate as regards its risk factors, preventive measures and consequences [60]. In a registry on the management of 571 Egyptian patients with postmenopausal and corticosteroid-induced osteoporosis, bisphosphonates, and calcium were the most frequent treatment [61].

Vasculitis

Results from Egyptian patients were included in a large international study validated classification criteria for cryoglobulinemic vasculitis and confirmed a good sensitivity and specificity [62]. In a multi-centre study on 630 Egyptian patients with vasculitis, HCV-associated vasculitis was the most frequent [63] and its development and medium-sized vessel involvement was associated with certain HLA II alleles [64]. Primary vasculitis Egyptian patients presenting with peripheral ischemia were found to require surgical attention [65].

Behçet's disease (BD)

In a nationwide study on more than a 1000 Egyptian Behçet's disease (BD) patients from all over the country, the prevalence was 4.35 being higher in Alexandria 13.8/100,000 inhabitants than previously reported while the male-to-female ratio 2.4:1 was more in harmony with the global ratios. The pattern of clinical presentation is unique for this country yet comparable to universally stated frequencies [66]. However, BD in Egyptians tended to show a higher frequency of vascular and neurological lesions [67]. In fact the International criteria for BD was highly sensitive with an acceptable specificity enabling early classification, management and an improved prognosis in a study on 461 Egyptian BD patients [68].

Gout

In an interesting recent review presented by an Egyptian rheumatologist, the prevalence of gout was reported to be 1–4% of the general population and may increase up to 10% in some countries being higher in men. Worldwide incidence of gout increases gradually due to poor dietary habits, lack of exercises, increased incidence of obesity and metabolic syndrome (MetS) [69, 70]. In a study on Egyptian patients with primary gout, the disease severity, serum uric acid level and development of punched-out erosions was closely related to insulin resistance and MetS [71].

Juvenile rheumatic diseases

Pediatric rheumatic diseases form a considerable cause of morbidity and mortality in black Africa as the corresponding service in the Sub-Sahara is missing with an obvious shortage of pediatric rheumatologists and related health professionals [72]. In this young population, some rheumatic diseases are caused by infection as rheumatic fever [73]. In a population-based epidemiologic survey of juvenile idiopathic arthritis (JIA) in Sharkia governorate, Egypt, the prevalence of JIA in children was 3.43/100,000, which was in agreement with the prevalence in Chinese children in Taiwan that was 3.8/100,000 yet much lower than that reported in US and Europe [74]. Surprisingly, 54 children and adolescents with JIA were at a significantly elevated risk of depression [75] and in another study from Upper Egypt there was an increased bone resorption [76]. Major organ affection and higher activity were more frequent in juvenile SLE cases compared to adult counterparts mandating an earlier and more careful assessment with strict management plans and follow-up in this vulnerable age group [77, 78].

An Egyptian version of a JIA patients' outcome measure has been constructed [79].

Sjögren's syndrome (SS)

Sharing in a big data Sjogren's project consortium including patients from Egypt the influence of geolocation and ethnicity on the phenotype expression of the disease was determined [80] and revealed how the immunological profile drives clinical phenotype of the disease at diagnosis [81].

Fibromyalgia syndrome (FMS)

In a study on 160 Egyptian patients with rheumatic diseases, fibromyalgia syndrome (FMS) was associated with SLE in 18%, RA in 14%, SSc in 6.7% and was less commonly present in BD patients (3.3%). FMS was found to be related to the disease activity in RA and BD patients and to thrombosis in SLE and affected the QoL in RA [82]. Of interest, an Arabic version has been adapted and validated for the fibromyalgia impact questionnaire on 51 Egyptian patients with FMS [83]. In a novel Egyptian study, hippocampal dysfunction has been implicated in the pathogenesis of this puzzling syndrome [84].

Familial Mediterranean fever (FMF)

An Egyptian study was able to identify a wide spectrum of MEFV mutations in 136 FMF patients and to study the phenotypic expression of the disease attributable to the existence of a particular mutation. The most frequent gene mutations in the studied group were V726A, M694V, M680I, E148Q and M694I in 41.2, 32.4, 29.4, 25, and 20.6%, respectively. M694V gene mutation was associated with increased frequency of abdominal pain, arthritis and the presence of amyloidosis. The increased frequency of V726A gene mutation and the rarity of amyloidosis in this study suggest that Egyptian patients may have a milder form of FMF compared to other populations [85].

Excitingly, the prevalence of connective tissue diseases among patients presenting with fever of unknown origin (FUO) to Ain Shams University hospitals was 24% in a descending order was mostly due to SLE, familial Mediterranean fever (FMF), RA, systemic onset JIA (Still's disease), rheumatic fever and Crohn's disease [86].

Comorbidities of rheumatic diseases

Few Egyptian investigators studied the comorbidities in rheumatic diseases. Egyptian RA patients when compared to the rest of the COMORA cohort study were found to have the highest HCV prevalence while depression, hypertension, and dyslipidemia were less prevalent [87]. In a study on 150 Egyptian RA patients, serum interferon-γ and its gene polymorphism played a role in the susceptibility to type-2 diabetes mellitus [88]. In Egyptian SLE patients with metabolic syndrome there was an increased risk of atherosclerosis associated with disease activity and damage [89]. Thyroid dysfunction was frequent among Egyptian SLE and RA patients and was associated with an increased cardiovascular risk [90]. Moreover, in another study on 100 SLE patients, hypothyroidism was frequent and its early detection was recommended to reduce the risk of musculoskeletal-related morbidity [91].

Vitamin D deficiency is a common problem worldwide with special predilection to the Middle East and was frequently reported in Egyptian RA [92], SLE [93], juvenile-onset SLE [94] and FMS [92, 95] patients. Deficiency caused flank pain in patients with 12th rib syndrome [96].

Rheumatic manifestations of systemic diseases

Interestingly, few studies focused on the rheumatic manifestations of patients with systemic diseases such as diabetes, hepatitis, renal disease, and malignancy. In a study on 200 Egyptian patients with type 1 and 2 diabetes mellitus, musculoskeletal manifestations were found with the following prevalence respectively: carpal tunnel syndrome (CTS) (14% and 5%), sclerodactyly (9% and 3%), Charcot joint (2% and 4%), limited joint mobility (2% and 6%), stenosing tenosynovitis (1% and 5%), shoulder capsulitis (1% and 10%), diffuse idiopathic skeletal hyperostosis (0% and 3%) and Dupuytren's contracture (0% and 1%). These manifestations were more prevalent in patients with longer disease duration, poor glycemic control, and dyslipidemia [97]. In an Egyptian study on a cohort of 306 patients with chronic HCV infection, the prevalence of rheumatologic manifestations was 16.3% with chronic fatigue syndrome and sicca symptoms being the most common, but no significant link to the degree of elevation of liver disease or viral load [98]. Out of 144 Egyptian patients on hemodialysis, 60.4% had musculoskeletal manifestations. The most common was arthralgia followed by OA, CTS and osteoporosis [99].

In a study on 60 Egyptian patients with various malignancies, musculoskeletal manifestations and associated rheumatic diseases or following the treatment represent a significant percentage of symptoms and signs which may raise a clue to the differential diagnosis [100]. In Egyptian patients with SS there was an increased risk of lymphoproliferative malignancy and B-cell non-Hodgkin lymphoma [101].

Biologics in Egypt

The Egyptian MOH published the first Egyptian guidelines for the registration of biologics in Egypt in 2015 in accordance with WHO standards, yet they have not led to the effective implementation of affordable drugs. Without a clear strategy to encourage the development and registration of biologics, Egypt faces the increasing risk that their cost of may place massive pressure on the healthcare budget in the near future, and moreover limit the quality of care that Egypt as a society is able to afford. Biosimilars will have a notable financial influence and enhance the quality of care provided [102]. More than half of the Chinese RA patients are not treated with DMARDs and 10.1% are treated with biologic and biosimilar agents [103]. A determined and strong stance was taken in Brazil to effectively implement a strategy that triggered the transition from purchasing generic imported drugs to domestically manufactured biologics [102].

Egyptian publications in rheumatology

Three Egyptian peer-reviewed journals that publish original articles within the various fields of rheumatology are available. The Egyptian Rheumatologist, managed by rheumatology staff members of Cairo University and hosted and produced by Elsevier, is currently ranking in the third quartile of classified rheumatology journals with a steadily rising impact factor; it is indexed on well-known international platforms as Scopus and web of science. Furthermore, the Egyptian Rheumatology and Rehabilitation Journal published by Wolters Kluwer under responsibility of the rheumatology and rehabilitation department of Ain Shams University. The Egyptian Journal of Rheumatology and Clinical Immunology is a more recent journal that is locally published and run by the rheumatology units of internal medicine departments. Interestingly, as a reflection of the inception of rheumatology as a part of the physical medicine and rehabilitation practice, the Rheumatology journal started as the Annals of Physical Medicine, later re-titled as Rheumatology and Rehabilitation [21].

The international contributions of Egyptian rheumatologists in top ranked rheumatology journal at all time were limited yet notably increasing and found to be 8 in the Annals of Rheumatic Disease [80, 104–110], 2 in Arthritis and Rheumatology [111, 112], 2 in Osteoarthritis and Cartilage [113, 114], 1 in Arthritis Research and Therapy [115], 3 in Rheumatology (Oxford) [62, 116, 117], 4 in Seminars in Arthritis and Rheumatism [118–121], and 1 in the Rheumatic Disease Clinics of North America [122]. Furthermore, there were numerous contributions in well known reputable rheumatology journals, indexed on the web of science and Scopus, by Egyptian Rheumatologists with 23 articles published in Journal of Rheumatology, 23 in Joint Bone and Spine, 29 in Lupus, 51 in Rheumatology International, 91 in Clinical Rheumatology, 32 in the International Journal of Rheumatic Diseases, 13 in Clinical and Experimental Rheumatology, 11 in Modern Rheumatology, 2 in Journal of Clinical Rheumatology, 6 in Pediatric Rheumatology, 3 in the Scandinavian Journal of Rheumatology, 3 in the International Journal of Rheumatology and more than 250 in the Egyptian Rheumatologist.

In the EULAR 2018, 69 abstracts have been published from Egypt and by the end of the same year 12 posters and 2 oral presentations took place in the ACR. Over the past 5 years, 236 abstracts have been published in the EULAR and 52 in the ACR as well as in many top ranked rheumatology journals, throwing light on the widely acceptable products of the Egyptian medical schools graduating rheumatologists. In harmony from counties with comparable challenges, the increasing number of papers and abstracts from India published in western rheumatology journals attests to the academic excellence of their institutions [10]. In 2018 India contributed by 59 EULAR abstracts and totally 240 over the last 5 years [7]. In China, the government funding for rheumatology research has increased substantially over the last decade and was supported by a number of grants enabling researchers to publish many high-quality papers in international scientific journals [6]. The Egyptian administration is now focusing on paying more attention and increasing the budgets for scientific research after several years of country unease.

Rheumatology associations in Egypt

Unlike in other countries, there are many official rheumatology-related associations in Egypt established since the 1960s of the last century including the Egyptian society of rheumatology (ESR), of rheumatic diseases (ESRD), of rheumatology and rehabilitation (EGYRAR) and for clinical immunology and rheumatology (EGYSIR). In collaboration with the Upper Egypt rheumatology, rehabilitation, and immunology society (UERRIS), the updated rheumatology foundation (URF) and the annual rheumatology and orthopedic meeting (AROM) emerged the Egyptian league against rheumatism (ELAR) in an attempt to synergize the efforts. Other focused societies are enforced and include the Egyptian society of osteoporosis and geriatrics, of back and joint pain and recently of musculoskeletal and neuromuscular sonography (ESMNS). Patient-focused societies are limited in number and activity and include the Egyptian society for lupus and for friends of RA and

autoimmune arthropathy. In a different scenario to that in Egypt with advances in the field, British university centers expanded and generated candidates for posts in rheumatology and general internal medicine, while dual trainees in rheumatology and rehabilitation continued the role formerly offered by physicians in physical medicine. However, emergence of the British Society of Rheumatology (BSR) sharply separated the divergent origins of the specialty and the British association of rheumatology and rehabilitation merged with another society avoiding a double existence of two societies with similar objectives [15]. Similarly, the Korean Rheumatism Association was later renamed the Korean College of Rheumatology (KCR) [13]. Leagues for rheumatologists have been constructed over several governorates of the country aiming to help in the CME and workshops. In 2017, the Egyptian College of Rheumatology (ECR) emerged as an umbrella to encompass the spectrum of scientific societies, leagues and organizations in Egypt; in an attempt to unify the national perspectives and guidelines. The ECR is potentially executing nationwide studies to have an approximate overview on the prevalence and pattern of rheumatic diseases starting with Behçet's disease [65].

In countries with comparable challenges, the Indian rheumatology association (IRA) and Pakistani rheumatology society are playing enormous educational roles to expand their influence to rheumatologists and non-rheumatologists in both community and hospital settings [10]. There are few existing Indian guidelines that should be updated and new ones for the management of rheumatic diseases in India are required [7]. Also the Chinese Rheumatology Association (CRA) plays an important role in the development of rheumatology in China and in the Asia-Pacific League of Associations for Rheumatology (APLAR). An effective task of the CRA over the last 30 years was to quantify the burden of rheumatic diseases on a nationwide epidemiologic scale and developed national guidelines [6]. Furthermore, founded in the early 1970s, the Iranian rheumatology society (IRS) is currently organizing an annual congress and two local symposiums in different cities of Iran [12]. Around the year, Egyptian rheumatologists favorably share in the 2 grand worldwide events; the EULAR and ACR aside many annual meetings for the rheumatology associations, societies and departments all over Egypt, Africa and the Middle East. The contribution and participation of Egyptian rheumatologists in the African League of Associations for Rheumatology (AFLAR) and Arab League Against Rheumatism (ArLAR) supports their interaction to improve the regional and continental practice and education of rheumatology. Frequent workshops and meetings are available through independent organizations or leagues with fees playing a role in the CME for junior rheumatologists.

Future perspectives

Despite the immense disputes and obstacles facing the Egyptian Rheumatology society, major urgent demands are called regarding many aspects to take large potential steps. Unifying the efforts of the many scientific societies to have an annual grand congress would be crucial to present the original and novel rheumatology findings for Egypt and share experience on a wider scale; thus starting to establish Egyptian rheumatology guidelines and indices. Cooperating with the other African leagues is crucial to enhance the field around the continent and boost the standard of performance of the African League Against Rheumatism (AFLAR) and narrow the gap with other continental leagues. Egypt, the country, manpower and resources, are ready and optimum for hosting grand rheumatology events and conferences not just over Africa and the Middle East, but also worldwide, hopefully in the near future.

Taking steps ahead in presenting the genetic mapping of rheumatic diseases in Egypt is ongoing to present the Genome-Wide Association Studies (GWAS) for that particular old ethnicity of the world. Large scale nationwide studies could soon potentially impact the development of guidelines compatible with the Egyptian patients and country circumstances. Meta-analysis of the already presented corresponding original articles should be encouraged.

Development of the rheumatology workforce and enhancing the provision of treatments for Egyptians of various socioeconomic classes will lead to a healthier, more productive population, with the improved standard of living that rheumatology residents rightly desire and deserve. Rheumatologists also need to lead the way in raising awareness of the importance of early diagnosis and early effective treatment of rheumatic diseases among patients, general practitioners and the government. Rheumatology is becoming one of the most promising clinical or scientific fields in Egypt, moving forwards rapidly with achievements in clinical practice, research and international recognition. Yet, in the meantime, a range of barriers, obstacles, and opportunities exist.

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