Chapter 9
General Oncology Care in Libya

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9.1 Libya Demographics

Libya is in the north of the African continent and its total land area is about 1.76 million km^2 [1]. The country was declared as an independent state on 24th December 1951. Tripoli is the capital of Libya and is in the Northern west while Benghazi is the second largest city and is in the Northern east. Libya depends on oil as the main source of income, and it has the 10th largest proven oil reserves in the world.

In 2020, the population of Libya was estimated to be 6.93 million [2]. Based on the 2006 Libyan Census, the estimated growth rate in the period from 1995 to 2006 was 1.8%. Almost 42% of the population are 19 years or younger and 4.2% are 65 years or older. The median age in Libya is 28.8 years and about 78.2% of population is urban [3].

9.2 Cancer Statistics in Libya

Benghazi Cancer Registry (BCR) is the first population-based cancer registry in Libya. It was established in 2002 in collaboration with Modena Cancer Registry and the National Center for Epidemiology of the Italian National Institute of Health [5]. The main office of BCR is currently present in Benghazi Medical Center. The results of BCR were published in volume X of Cancer Incidence in Five Continents (2014), which is one of the publications of International Association of Cancer

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Registries (IACR) [4]. It is also published in other international journals [5]. It covers a population of 1.58 million people in the eastern part of Libya as per 2006 census (28% of Libyan population). Other hospital-based registry reports were published from cancer centers in Sabratha and Misrata and non-published data from Tripoli Oncology Departments. These hospital-based data are consistent with the population-based cancer registry of Benghazi.

The data of a total of 3396 new cancer cases were diagnosed in Eastern Libya during the calendar period from 2003 to 2005 (Table 9.1) [4]. The Age-Standardized

Table 9.1 Benghazi Cancer Registry Data [4]. Used with permission from International Agency for Research on Cancer (IARC/WHO)

***Libya, Benghazi (2003-2005)**

	Male						Female						
SITE	No. cases	Freq. (%)	Crude rate (per 100,000)	ASR world	Cum. rates 0-64 (%)	Cum. rates 0-74	No. cases	Freq. (%)	Crude rate (per 100,000)	ASR world	Cum. rates 0-64 (%)	Cum. rates 0-74	ICD-10
Lip	2	0.1	0.1	**0.2**	0.01	0.01	1	0.1	0.0	**0.1**	0.00	0.03	*C00*
Tongue	5	0.3	0.2	**0.4**	0.03	0.06	3	0.2	0.1	**0.2**	0.01	0.01	*C01-02*
Mouth	8	0.5	0.3	**0.7**	0.03	0.09	9	0.6	0.4	**0.8**	0.08	0.10	*C03-06*
Salivary glands	3	0.2	0.1	**0.2**	0.02	0.02	5	0.3	0.2	**0.3**	0.03	0.03	*C07-08*
Tonsil	2	0.1	0.1	**0.2**	0.02	0.02	0	0.0	0.0	**0.0**	0.00	0.00	*C09*
Other oropharynx	0	0.0	0.0	**0.0**	0.00	0.00	1	0.1	0.0	**0.1**	0.00	0.01	*C10*
Nasopharynx	42	2.4	1.8	**2.8**	0.21	0.31	25	1.6	1.1	**1.4**	1.10	0.16	*C11*
Hypopharynx	2	0.1	0.1	**0.2**	0.00	0.00	1	0.1	0.0	**0.0**	0.00	0.00	*C12-13*
Pharynx. unspecified	1	0.1	0.0	**0.1**	0.01	0.01	2	0.1	0.1	**0.2**	0.02	0.02	*C14*
Oesophagus	18	1.8	0.8	**1.6**	0.08	0.23	3	0.2	0.1	**0.2**	0.01	0.01	*C15*
Stomach	62	3.6	2.6	**4.9**	0.26	0.59	37	2.3	1.6	**3.0**	0.15	0.41	*C16*
Small intestine	3	0.2	0.1	**0.3**	0.01	0.04	4	0.3	0.2	**0.3**	0.02	0.02	*C17*
Colon	111	6.4	4.6	**8.8**	0.51	1.10	126	8.0	5.6	**9.0**	0.53	1.06	*C18*
Rectum	64	3.7	2.7	**5.0**	0.29	0.66	48	3.0	2.1	**3.3**	0.24	0.39	*C19-20*
Arus	5	0.3	0.2	**0.3**	0.02	0.02	3	0.2	0.1	**0.2**	0.02	0.02	*C21*
Liver	58	3.3	2.4	**4.9**	0.19	0.66	44	2.8	1.9	**3.7**	0.18	0.48	*C22*
Gallbladder etc.	17	1.0	0.7	**1.3**	0.10	0.13	42	2.7	1.9	**3.2**	0.19	0.30	*C23-24*
Pancreas	64	3.7	2.7	**5.4**	0.26	0.67	37	2.3	1.6	**2.9**	0.17	0.29	*C25*
Nose, sinuses etc.	5	0.3	0.2	**0.4**	0.02	0.06	1	0.1	0.0	**0.1**	0.01	0.01	*C30-31*
Larynx	66	3.8	2.8	**5.5**	0.33	0.63	8	0.5	0.4	**0.7**	0.05	0.09	*C32*
Trachea, bronchus and lung	326	18.7	13.7	**27.8**	1.34	3.67	37	2.3	1.6	**3.1**	0.18	0.40	*C33-34*
Other thoracic organs	1	0.1	0.0	**0.0**	0.00	0.00	3	0.2	0.1	**0.2**	0.01	0.03	*C37-38*
Bone	12	0.7	0.5	**0.4**	0.02	0.02	16	1.0	0.7	**0.8**	0.05	0.07	*C40-41*
Melanoma of skin	4	0.2	0.2	**0.2**	0.02	0.02	5	0.3	0.2	**0.3**	0.04	0.04	*C43*
Other skin	47		2.0	**3.8**	0.11	0.44	26		1.1	**2.1**	0.08	0.24	*C44*
Mesothelioma	3	0.2	0.1	**0.3**	0.01	0.03	0	0.0	0.0	**0.0**	0.00	0.00	*C45*
Kaposi sarcoma	6	0.3	0.3	**0.5**	0.02	0.07	1	0.1	0.0	**0.1**	0.01	0.01	*C46*
Connective and soft tissue	41	2.4	1.7	**2.4**	0.14	0.24	38	2.4	1.7	**2.3**	0.15	0.23	*C47-C49*
Breast	6	0.3	0.3	**0.5**	0.03	0.08	364	23.0	16.0	**22.9**	1.82	2.46	*C50*
Vulva							5	0.3	0.2	**0.4**	0.01	0.04	*C51*
Vagina							3	0.2	0.1	**0.2**	0.02	0.02	*C52*
Cervix uteri							62	3.9	2.7	**4.5**	0.36	0.48	*C53*
Corpus uteri							7	0.4	0.3	**0.6**	0.02	0.10	*C54*
Uterus unspecified							98	6.2	4.3	**8.3**	0.62	1.08	*C55*
Ovary							75	4.7	3.3	**4.7**	0.33	0.49	*C56*
Other female genital organs							0	0.0	0.0	**0.0**	0.00	0.00	*C57*
Placenta							0	0.0	0.0	**0.0**	0.00	0.00	*C58*
Penis	0	0.0	0.0	**0.0**	0.00	0.00							*C60*
Prostate	162	9.3	6.8	**14.7**	0.29	1.74							*C61*
Testis	10	0.6	0.4	**0.6**	0.05	0.05							*C62*
Other male genital organs	0	0.0	0.0	**0.0**	0.00	0.00							*C63*
Kidney	51	2.9	2.1	**3.9**	0.20	0.40	27	1.7	1.2	**2.0**	0.12	0.22	*C64*
Renal pelvis	2	0.1	0.1	**0.1**	0.01	0.01	0	0.0	0.0	**0.0**	0.00	0.00	*C65*
Useter	0	0.0	0.0	**0.0**	0.00	0.00	1	0.1	0.0	**0.1**	0.00	0.00	*C66*
Bladder	174	10.0	7.3	**14.9**	0.64	1.74	26	1.6	1.1	**2.3**	0.10	0.36	*C67*
Other urinary organs	1	0.1	0.0	**0.1**	0.00	0.03	0	0.0	0.0	**0.0**	0.00	0.00	*C68*
Eye	4	0.2	0.2	**0.2**	0.01	0.01	6	0.4	0.3	**0.3**	0.01	0.04	*C69*
Brain, nervous system	87	5.0	3.6	**5.2**	0.38	0.62	50	3.2	2.2	**3.0**	0.16	0.32	*C70-72*
Thyroid	13	0.7	0.5	**0.8**	0.06	0.07	64	4.0	2.8	**3.8**	0.25	0.37	*C73*
Adrenal gland	3	0.2	0.1	**0.1**	0.01	0.01	4	0.3	0.2	**0.2**	0.01	0.02	*C74*
Other endoceine	0	0.0	0.0	**0.0**	0.00	0.00	2	0.1	0.1	**0.1**	0.01	0.01	*C75*
Hodgkin lymphoma	38	2.2	1.6	**1.6**	0.11	0.11	44	2.8	1.9	**1.8**	0.13	0.15	*C81*
Non-Hodgkin lymphoma	88	5.1	3.7	**5.8**	0.31	0.70	67	4.2	3.0	**4.3**	0.26	0.45	*C82-85,C96*
Immunoproliferative diseases	0	0.0	0.0	**0.0**	0.00	0.00	0	0.0	0.0	**0.0**	0.00	0.00	*C88*
Multiple myeloms	18	1.0	0.8	**1.6**	0.08	0.19	16	1.0	0.7	**1.2**	0.08	0.14	*C90*
Lymphoid leukaemia	27	1.6	1.1	**1.4**	0.06	0.08	24	1.5	1.1	**1.2**	0.05	0.10	*C91*
Myeloid leukaemia	43	2.5	1.8	**2.7**	0.15	0.30	48	3.0	2.1	**2.9**	0.19	0.31	*C92-94*
Leukaemia unspecified	10	0.6	0.4	**0.7**	0.06	0.09	15	0.9	0.7	**0.7**	0.06	0.06	*C95*
Myeloproliferative disorders	8	0.5	0.3	**0.5**	0.05	0.07	11	0.7	0.5	**0.9**	0.05	0.11	*MPD*
Myelodysplastic syndromes	3	0.2	0.1	**0.1**	0.01	0.01	0	0.0	0.0	**0.0**	0.00	0.00	*MDS*
Other and unspecified	60	3.5	2.5	**4.7**	0.23	0.53	65	4.1	2.9	**4.9**	0.22	0.54	*O&U*
All sites	1786		74.8	**138.5**	6.78	16.62	1640		71.0	**110.0**	7.21	12.32	*C00-96*
All sites except C44	1739	100.0	72.8	**134.6**	6.67	16.19	1584	100.0	69.8	**107.9**	7.13	12.08	*C00-96 exc. C44*

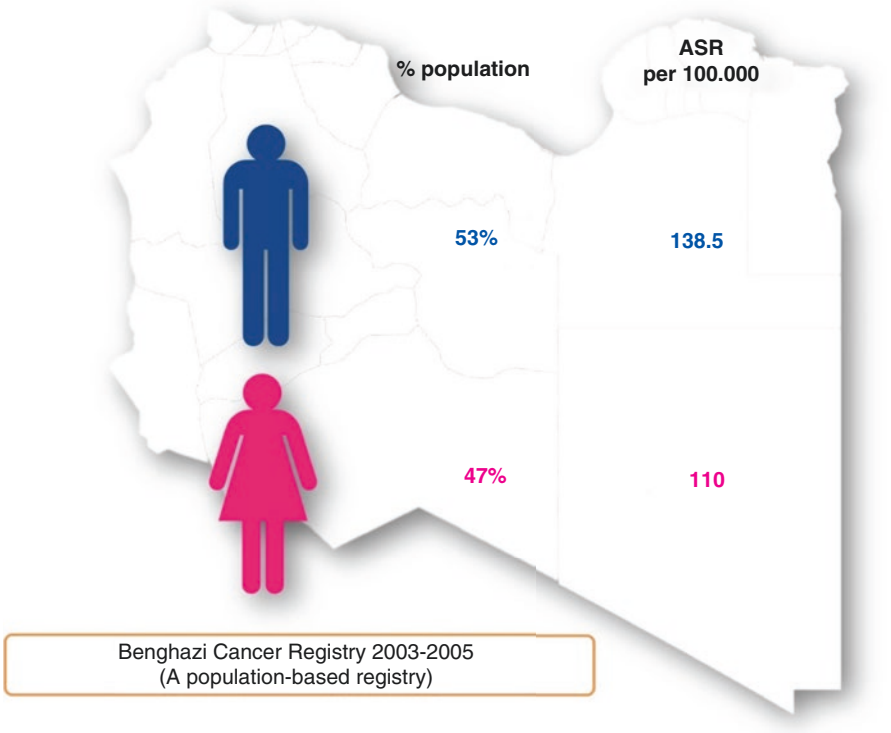

Fig. 9.1 ASR for all cancer sites, BCR 2003–2005 [4]

Rate (ASR) was 138.5 and 110 per 100,000 for men and women, respectively (Fig. 9.1) [4]. There was a slight male excess (53% of all cancer cases). The incidence of disease was found to increase with age, presenting a median age at diagnosis of 61 years for males and 50 years for females.

Among men, cancers of lung (18.7%), colorectum (10.1%), bladder (10.0%), prostate (9.3%), and Non-Hodgkin lymphoma (5.1%) represented the most frequently reported malignancies, whereas the five most diagnosed types of cancer among women were breast (23.0%), colorectum (11.0%), uterus (unspecified) (6.2%), leukemias (5.5%), and ovary (4.7%) (Fig. 9.2) [4].

The most lethal cancers in both sexes combined were lung cancer showing a 5-year Relative Survival (RS) of 2.3%, followed by liver cancer with a 5-year RS of 2.4%, and stomach cancer with a 5-year RS of 3.3%. Thyroid, breast, and colorectal cancers were associated with a best prognosis showing a 5-year RS of 64.9%, 56%, and 29.5%, respectively [5].

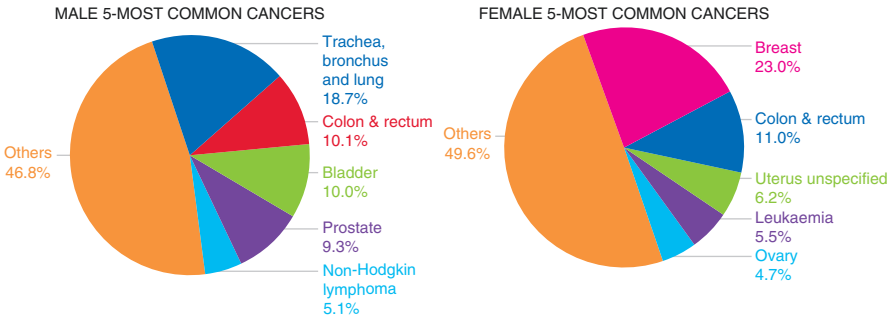

Fig. 9.2 Five most common cancers in both sexes, BCR 2003–2005 [4]

9.3 Healthcare System in Libya

The unstable political situation had adversely affected the provision of healthcare in the country. Still the services are free but suffer disruptions of continuity of care, which has resulted from drug and diagnostic reagents unavailability. These issues are more clearly reflected on patients suffering from chronic diseases including cancer.

Health care delivery in Libya is organized into three levels of care: primary, secondary, and tertiary. The primary health care level includes the services delivered in primary health care units and polyclinics. The secondary care level is formed of hospitals either general hospitals or rural hospitals and the tertiary level includes the university hospitals and the specialty-oriented hospitals and centers such as the cardiac, eye, oncology, diabetes, trauma, chest, and psychiatric hospitals. Cancer is the second leading cause of death in Libya after cardiovascular diseases (The Report on the causes of death in Libya, data analysis of causes of death in the years 2016–2017; Health Information Center, Ministry of Health—Libya, 2019) [19].

9.4 Oncology Care in Libya

Specialist cancer care in Libya started in the late 1970s in both Tripoli and Benghazi. It started as hematology and oncology clinics as part of the general medical and pediatric departments. In Tripoli, the adult oncology service was based at the Department of Medicine of Tripoli Central Hospital, while the pediatric oncology/hematology services were based at Aljala Children's hospital. In Benghazi, Howari

hospital was the first hospital to deliver comprehensive cancer care in the eastern part of Libya.

The first cobalt radiotherapy machine was operated in Tripoli Central Hospital in the 1980s. In 1994, in Sabratha—80 km west to Tripoli—a new cancer center was established. In 1995, a radiotherapy center was established in Benghazi. In 1996, the new 1200 beds Tripoli Medical Center was opened; it contained a 78-beds department for medical oncology and hematology, a 39-beds department of pediatric oncology that moved from the old unit in Aljala Children's Hospital. In 1998, a Medical Oncology unit at Al-Jamhoriya Hospital in Benghazi was established; in the same year the second radiotherapy department was launched at Tripoli Medical Center with a cobalt machine first and now it has two linear accelerators and a brachytherapy service. In 2005, a medical oncology service was launched in Misrata initially as a branch of Sabratha Cancer Center, then in 2007, it became Misrata Cancer Centre. Figure 9.3 shows the development of oncology in Libya.

In 2016, a new medical oncology service was launched in Sebha in collaboration with Sabratha Cancer Centre. In 2017, new medical oncology units were opened in Tobruk, Albayda, Ajdabiya, Sirt, and Zintan. In 2018, radiotherapy services were launched in Misrata Cancer Center and in January 2021, the radiotherapy services in Sabratha were launched.

Recently, a decree to establish Tripoli Cancer Center was signed to organize and modernize cancer care in the Tripoli area, where almost a third of the Libyan

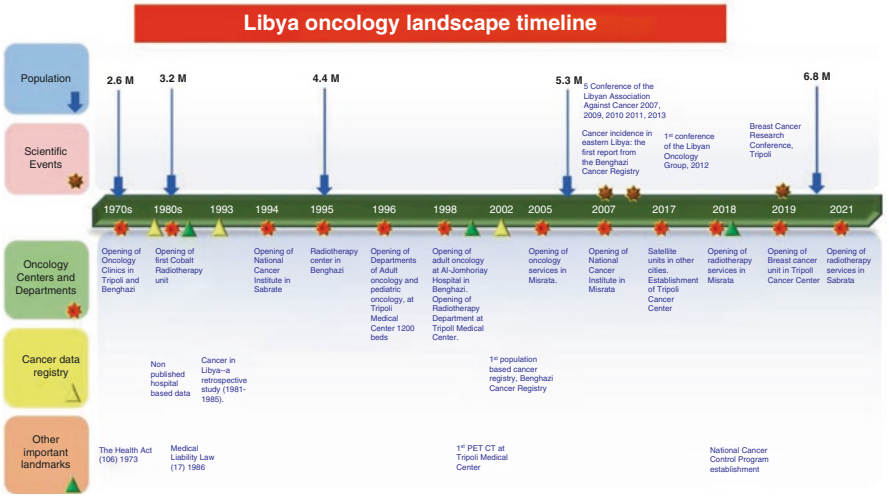

Fig. 9.3 Development of Oncology in Libya [4, 5]

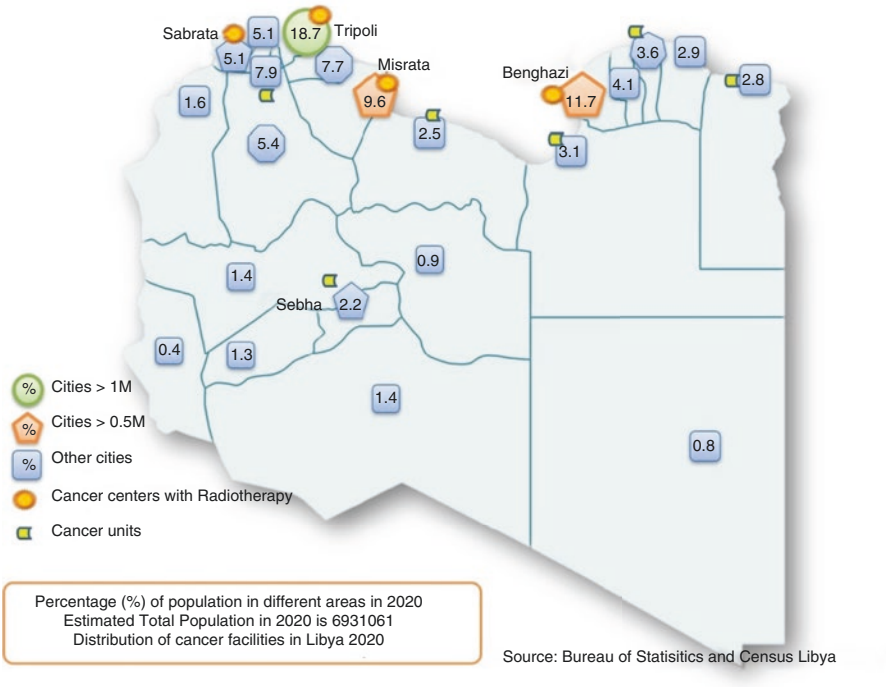

Fig. 9.4 Distribution of current cancer services in Libya [2]. Source: Bureau of Statistics and Census Libya

population live. It has already started with a dedicated Breast Cancer unit, opened in July 2019. It provides diagnostic and therapeutic services to breast cancer patients. This expansion of services allowed cancer patients to access facilities closer to their residential areas (Fig. 9.4).

A Bone Marrow Transplant (BMT) unit was established at Sabratha Cancer Center in collaboration with an Italian team that unfortunately stopped because of the political conflict. As mentioned earlier, the whole cost of oncology care of all Libyan citizens is fully funded by the government either locally or abroad, in case there is a need to refer patients for treatment abroad.

Private oncology care, particularly medical and surgical oncology has emerged and started providing their services, the cost is covered as out-of-pocket or through insurance and on some occasions, it is covered by the government, when there is a huge pressure on the public hospitals, particularly during COVID-19 Crisis.

9.5 Cancer Risk Factors

Cigarette smoking is an important modifiable risk factor for cancer in Libya. In a study published in 2014 on random samples from different Libyan cities (33,739 males and 33,527 females) about cigarette smoking, 15.5% were smokers and the

highest age interval of smoking was 40–49 years. Cigarette smoking is more common in males (23.9%) than females (1.7%) [9]. The second risk factor is childhood obesity, a study showed that 30% of the children are obese, males are more affected, with the highest percentage is in Tripoli and the lowest in Sabha [10]. In Libya, STEPS Survey 2009 (WHO) showed 30.5% of the population studied were obese (BMI ≥30, males 21.4%, females 40.1%) [10]. Physical inactivity is another well recognized risk factor, in Libya STEPS Survey 2009 (WHO) showed that 43.9% of adults have low levels of activity (defined as <600 MET-minutes per week) [10].

Hepatitis B and C infections are risk factors for Hepatocellular Carcinoma (HCC). In a study published in 2000, the prevalence of hepatitis B in healthcare workers was 4% [11]. In a more recent study published in 2001, the prevalence of HBV surface antigen (HBsAg) and anti-HCV was 2.2% and 1.3%, respectively, among the general population [12]. Although the studies were different in design, a drop in hepatitis B prevalence was observed. This is possibly due to the introduction of hepatitis B vaccination. HPV infections are related to cervical cancer and oral cancer. In a study published in 2019, the overall prevalence of the most common oncogenic HPV types was 4.5% [13].

Dietary habits are also important risk factors for cancer in Libya. Libya STEPS Survey 2009 (WHO) showed that 97.4% of adults eat less than five servings of fruits/vegetables per day [10]. The BRCA mutation is an important risk factor for breast and ovarian cancers. In a systematic review and meta-analysis study published in 2019, the pool estimate of BRCA mutations among women with hereditary breast and ovarian cancer in the Arab countries was 20% [14].

9.6 Cancer Screening Programs

Unfortunately, patients diagnosed with cancer in Libya are still present in later stages [6, 7]. Hence, awareness of the need for early diagnosis is required, especially those cancers whose screening has proved effective. The breast and colon are among the common cancers in Libya. They constitute almost 21% of cases in both sexes.

Screening activities are not based on well-structured government led programs; it is an initiative of Non-Governmental Organizations (NGOs) in collaboration with the health sector. Awareness campaigns about the importance of early detection of breast cancer started in 2008 by a group of active Libyan doctors in both Benghazi and Tripoli through regular and organized visits to girl schools, women's groups in governmental and private institutes, and through local media and Internet. This effort helped to change some attitudes and beliefs in our community towards breast cancer and increased the awareness of the benefits of its early detection. Since 2011, every October, breast cancer screening campaigns have become a regular event. Breast cancer screening units were established at many of the primary healthcare facilities that accept women for screening and early detection in major cities.

The first early detection units for breast cancer in both Tripoli and Benghazi were opened in 2017 in Alkesh polyclinic-Benghazi, later moved to Benghazi Medical Center, Al-Badri and Triq Al-Matar polyclinics-Tripoli and thereafter, many other clinics opened in other cities. This initiative was highly successful and unexpectedly the units received a large number of women. The early detection clinics work in coordination with multidisciplinary teams of pathology, surgery, oncology, radiotherapy, and radiology departments, to agree on the appropriate management recommendation for these screened women. The early detection units provide screening and diagnostic mammography, ultrasound scan for ladies, who are before the age of screening mammogram and breast diagnostic intervention (FNAC & Tru-cut biopsy).

In one series reported from Benghazi, the breast cancer detection rate was around 20%. Interestingly, almost more than a third of these cases were at an advanced stage [8]. An awareness campaign for cervical cancer was launched in many cities of Libya in January 2020, the campaign of 2021 used the digital platform.

9.7 Cancer Prevention Programs

Smoking is officially banned in public places and to sell it to underage by the law (206) issued in the year 2009. This law also bans tobacco advertisements and enforces tobacco factories to put a warning label on the cigarette packets.

Hepatitis B vaccination programs were started in Libya in the late 1980s and were incorporated in the National Immunization Program in 2001. Libya reported the highest estimate of vaccination in African countries [15]. In 2003–2005, Benghazi cancer registry, hepatocellular carcinoma constituted only 3% of all cancers [4]. This could be explained by the effective vaccination program.

Interestingly, the incidence of cervical cancer in 2004 was one of the lowest in the world. This is most likely due to lower incidence of extramarital relations and the protective role of male circumcision [16]. In anticipation of changes in cancer incidence and social changes, the HPV vaccination was introduced in Libya in 2013 and targeted young females only. It is not yet included in the compulsory vaccination list.

9.8 Cancer Diagnosis

9.8.1 Imaging

Ultrasound, Computed Tomography (CT), and Magnetic Resonance Imaging (MRI) scans are available in all hospitals taking care of cancer patients. Positron Emission Tomography (PET/CT) scan is available at Tripoli University Hospital. Nuclear medicine departments services like bone isotope scan and a multigated

acquisition (MUGA) scan are available in some hospitals. Interventional radiology services such as CT-guided lung biopsy and US-guided liver biopsy are available at the major hospitals.

9.8.2 Laboratory

There are six pathology laboratories in the governmental hospitals, one in Sabratha, Misrata, Benghazi and three in Tripoli. However, many private pathology laboratories are delivering their services in various cities. Pathology laboratories are performing routine pathological examination as well as immunohistochemical studies.

Some of the biomarker testing such as RAS in colorectal cancer is done in two of the governmental laboratories, i.e. Sabratha and Misrata. EGFR, ALK, ROS1, and BRAF for lung cancer testing are done in a private laboratory. Currently, PD-L1 testing is sponsored by pharmaceutical companies. Other molecular testing like the BCR-ABL gene testing is performed in Tripoli. Flow cytometry is also available in some of these laboratories. Cytogenetics is referred abroad through few governmental and private laboratories. The tests for hereditary breast and ovarian cancer (BRCA1 & 2) can also be referred and sent abroad through hospital arrangements.

9.9 Treatment

9.9.1 Medical Oncology

Medical oncology and radiation oncology are separate specialties in Libya, while hemato-oncology is a separate specialty in some centers and covered with medical oncology in others. Almost all oncologists are Libyans, and the majority received their postgraduate training locally. For more details about the training, please refer to the education section. Medical oncology and hematology specialists (Adult and Children) are estimated to be around 57 (0.82 per 100.000 population), and the radiation oncologists are estimated to be around 14 (0.2 per 100.000 population). The number of specialists in oncology remains less compared to North America [17].

9.9.1.1 Advanced Treatments

U.S. Food and Drug Administration (FDA) and/or European Medicines Agency (EMA) approved innovative medications including immunotherapy and targeted treatments. These are offered to the patients in Libya through different governmental hospitals. However, political instability adversely affected the timely budgeting, processing, and importing of essential drugs. Furthermore, frequent closure of airports and ports added to the delay of arrival of medicines and other supplies.

9.9.1.2 Bone Marrow Transplantation

Bone Marrow Transplantation (BMT) unit was established in Sabratha in 2003, it contained two laminar flow rooms and was operated in collaboration with Hematology Division, San Martino's Hospital, Genova, Italy. Then it was operated with visiting doctors from Egypt. It is currently non-operational due to the current situation in the country. A new Bone Marrow Transplant unit is under construction in Misrata that is expected to be in service in 2022.

9.9.2 Radiation Therapy

There are 6 radiation oncology units in Libya, 1 in Sabratha (1 Linac, brachytherapy), 1 in Misrata (2 Linac, brachytherapy), 2 units in Tripoli (1 with cobalt, the other has 1 cobalt, 2 Linac and brachytherapy), 2 units in Benghazi each with 1 Linac. The nuclear medicine departments are in Tripoli, Benghazi, Misrata, and Sabratha. PET CT service is available only in Tripoli. Due to the current political instability and shortage of essential operational substances, some of these units are out of service.

9.9.3 Surgery

The dedicated surgical oncology departments are available at Sabratha and Misrata cancer centers. They perform routine oncological surgery for most of the sites. In Tripoli and Benghazi, oncological surgery is performed by surgical departments in the Major Hospitals. Advanced surgical techniques like laparoscopic surgery are available, but robotic surgery has not been introduced yet. The occasional patients, who are deemed appropriate for the Hyperthermic Intraperitoneal Chemotherapy (HIPEC) procedure, are referred abroad.

9.9.4 Pediatric Oncology

Childhood cancer represents 4% of all malignant cancers reported in Benghazi Cancer Registry data [18]. Three hematology and oncology units for pediatrics are in pediatric hospital-Benghazi, Tripoli University Hospital, and Misrata Cancer Center. They are busy units and serve the whole country.

9.9.5 Survivorship Track

Formal survivorship clinics do not exist and patients who have completed their active treatment will continue their surveillance and follow-up at the medical oncology clinics. This includes patients who had their treatment at these clinics as well as those who did not have systemic therapy. Some patients may prefer to be followed-up in the private sector. For patients who were treated abroad, follow-up at the hospital would be more convenient to them.

9.9.6 Palliative Care Track

The palliative care for advanced cancer patients is very important especially that we still see a high proportion of patients in the advanced stage. The care of these patients is not limited to oncology units but also in medical or surgical departments. There are pain clinics that are primarily run by anesthesia specialists in collaboration with oncologists. Unfortunately, there is a significant shortage of this essential service across the country and the National Cancer Control Program is trying to address this issue.

9.10 Research and Education

9.10.1 Research

Most of internationally published oncology research in Libya is limited to epidemiological studies, case reports, and single center experiences. There is no infrastructure and necessary personnel to conduct phase 1, 2, or 3 clinical trials, especially in the current difficult times of the country.

9.10.2 Education and Training

Oncology is incorporated into the curricula of the main medical schools in Libya. Post graduate training is conducted under the umbrella of the Libyan Board of Medical Specialties, which was established in 1994. Medical oncology and hematology training are incorporated into the General Medical Training Program, while radiation oncology, pathology, and diagnostic radiology have their separate training programs. Diploma degrees in medical oncology and pediatric oncology were started in 2020, offered by private academies and recognized by the Ministry of Health.

9.11 Cost-Effective Cancer Care

The increasing cost of cancer care is a global issue faced by all societies around the world. The need for more sophisticated and high technology diagnostic procedures, high cost of the new antineoplastic agents such as immunotherapies and targeted therapies, the advances in cancer treatment resulted in long survival of increasing number of patients who may require expensive maintenance therapy for many years, the complexity of care needs large multidisciplinary team to address the needs of cancer patients. All these factors inevitably lead to soaring costs of cancer care.

Although the diagnostic workup and treatment of cancer are primarily covered by the government, which constitutes a large portion of the health care budget. However, in the current circumstances of the country that led to supply interruptions, patients may have to bear some of the cost of their treatment.

In Libya, one of the well-established strategies for cost saving is the bulk purchasing of drugs from the pharmaceutical industry rather than individual hospital purchasing. Furthermore, there is an increased awareness among the oncology community and policy makers of the high cost of cancer care. In the heart of cost saving approaches there is an emphasis on considering the use of biosimilars in cancer treatment as a proven strategy already adopted by many other countries.

Attempts to regulate the use of advanced imaging modalities such as PET/CT scan, MRI or CT scans have been implemented to decrease the cost of imaging that cancer patients often need. Further attempts to reduce the cost of cancer care is to invest more in early detection, which is a well-established way of reducing the cost through having more patients diagnosed earlier and avoiding the usually higher cost of advanced-stage care. In recent years, there are regular campaigns to increase the awareness of the importance of the early diagnosis of cancer and opening of clinics of early detection across several cities in the country. Currently, many Libyan patients are seeking treatment abroad and naturally this is more expensive than local treatment. Therefore, there are many efforts to reduce the number of patients traveling abroad by investing in making more specialized cancer care available and more readily accessible by opening more specialist oncology units in different cities across the country.

9.12 Challenges and Advantages

9.12.1 Medical Tourism in Libya

Cancer patients constitute the highest percentage of Libyan patients treated abroad; most of them in the neighboring countries. Treatment abroad is supported by the government. A specialized committee oversees the whole procedures of treatment abroad including the eligibility of patients.

On the other hand, because of the location and climate of Libya, it is a potential place for medical tourism from neighboring countries. This seems to be feasible soon because of the striving private health care sector in Libya once political stability is achieved.

9.13 The Future of Cancer Care in Libya

Although healthcare in general and cancer care in particular are facing considerable challenges currently due to political and economic instability of the country as well as COVID-19 crisis. However, there are ambitious plans and strategies to transform cancer care in Libya in the coming years.

- *The National Cancer Control Program:* The program was launched in 2019. It is a governance body that is responsible for putting the cancer control plans, supervising the population-based cancer registry, setting the standards of the cancer care, updating the essential cancer medicine list on a regular basis, organizing the training programs and supervising the NGO activities directed towards cancer awareness and early detection.
- *Cancer Registry*: In a meeting with WHO and International Agency for Research on Cancer (IARC) late in 2016, agreed to start a population-based cancer registry both in Tripoli and Benghazi regions and to improve hospital-based cancer registry in other regions.
- *National Cancer Screening Programs:* In collaboration with other stakeholders, the National Cancer Control Program is planning to start two or more pilot projects for breast cancer screening.
- *Strategic Cancer Areas:* The National Cancer Control Program recommended to divide the country into five strategic cancer areas, each having a comprehensive cancer center and satellite units. This initiative will improve access of patients in remote areas to effective cancer care and will ensure equity in health care delivery across the country.
- *Sustainable Supply of Essential Cancer Medicines:* To explore different options of securing continuous supply of cancer medicines, for example, signing long-term contracts with the major pharmaceutical companies to guarantee continuous supply.
- *Bone Marrow Transplant:* It is one of the essential services that are unfortunately currently unavailable, and there is a big effort to resume the service in Sabratha and to open new transplant units in other centers.
- *Palliative Care*: This area is still not well developed in Libya and there is a bad need for introducing the service in the cancer centers. Training specialists in the field and building enough capacity are among the priorities of the government.
- *Private Sector:* It is striving and complements the public service, regulations and support for the private sector is necessary to augment cancer care based on international standards.

9.14 Conclusion

The cancer incidence rate is rising worldwide, and Libya is not an exception. The complexity of care, the soaring cost, high expectations of patients and their families are global challenges. The situation in Libya is further complicated by fragility of the healthcare system, the large size of the country with long distances between cities and towns, and lack of national programs. Despite all these challenges, the oncology services in Libya are covering a wide range of population and providing decent oncology care. The establishment of The National Cancer Control Program will certainly help to improve the cancer care in Libya and overcome these challenges in the coming years.

Conflict of Interest Authors have no conflict of interest to declare.

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