

Radiology in Israel: What Is Happening?

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The State of Israel was established in 1948, and the current population is approximately 7.2 million [1]. The Israel Radiological Association (ISRA) was founded in 1927, 21 years before the establishment of the State of Israel. Founding ISRA members emigrated mainly from Central Europe, the birthplace of Wilhelm C. Roentgen and radiology. The language used at scientific meetings of the association was initially German, and only later changed to Hebrew. Currently, the radiology community in Israel includes 570 radiologists. The ISRA has several subspecialty working groups including neuroradiology, interventional radiology, sonography, cardiothoracic imaging, musculoskeletal radiology, breast imaging, and abdominal imaging.

The ISRA is a member of the International Society of Radiology (ISR) and took part in establishing the AFIIM (Association Franco-Israélienne d'Imagerie Médicale), a joint association with the French Society of Radiology (SFR). Eight AFIIM meetings have been held to date. Another joint society, the East Mediterranean Congress of Magnetic Resonance, was formed together with Turkey and Greece, and is in the process of being endorsed by the International Society for Magnetic Resonance in Imaging (ISMRM) [2]. Previous meetings of this joint society have been held in Izmir, Turkey, and Athens, Greece. The Israel Ultrasound Society is a full member of the European Federation of Societies for Ultrasound in Medicine and Biology (EFSUMB) [3].

The radiology training program in Israel is a 5-year program, not including a 1-year rotating internship that is completed before residencies begin. All radiology training positions are full-time with salary and include a minimal number of compulsory night calls. The radiology residency includes 45 months of radiology, 3 months of nuclear medicine, 6

months of clinical rotation, and a 6-month basic science project. Radiology residents complete compulsory rotations through the imaging subspecialties. A committee of the Scientific Council of the Israel Medical Association supervises training facilities, and participating departments must conform to strict requirements. Small hospitals that are unable to provide all the required rotations are not granted full recognition and must send their residents for supplementary training in major medical centers. Currently, 19 medical centers and hospitals in Israel have partial or complete radiology training programs.

Every training radiologist completes two certification examinations: a written examination halfway through the residency program and an oral examination during the final year of training. The written examination is offered annually and includes 160 multiple-choice questions covering nine subspecialty fields: cardiothoracic, musculoskeletal, pediatric, gastrointestinal, genitourinary, and breast imaging and neuroradiology, interventional radiology, and sonography as well as a physics section. The oral examination is a standardized, structured examination offered biannually that includes nine stations according to the required subspecialty fields listed previously [4].

The radiology examination board has recently introduced a computerized Web-based system for preparation of the oral examination by expert radiologists from around the country. A similar system is now being developed for preparation of the written examination. Both the written and oral examinations are computer-based and use specialized software developed in Israel.

A two-semester postgraduate course in radiology is offered by the Faculty of Medicine of the Tel Aviv University. Radiology residents from around the country attend this course, which covers most aspects of radiology in

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5-year cycles. The program includes 32 weekly meetings of 4 hours each.

Many young radiologists complete fellowships or visiting radiology professorships in the United States or Canada after their residencies; thus, the standard of radiologic practice and training in Israel is very much influenced by North American radiology.

Academic activity on the national level includes an annual meeting of the ISRA, with peer-reviewed scientific sessions and invited guest lectures. An annual sonography meeting with free communications and guest lectures, the Barry B. Goldberg Lecture, has also been held for the past 26 years. Both meetings are held in English to enable international participation and attendance. Other annual events include lectures delivered by distinguished international lecturers. Among them are the Benjamin Felson Lecture, the Leo Rigler Lecture, and the Beth Israel–Rambam Lecture. Israeli radiologists publish primarily in international journals, as well as in national peer-reviewed medical journals published in English (*Israel Medical Association Journal* [5]) and Hebrew (*Harefuah* [6]).

Academic positions are held only by radiologists in departments affiliated with one of four medical schools: the Hebrew University in Jerusalem, the Tel Aviv University, the Technion in Haifa, and the Ben Gurion University in Beer Sheva. A fifth medical school is planned for the region of Galilee in northern Israel. Academic appointments and advancements are granted according to strict criteria including teaching, research, and publication.

The Israeli Ministry of Health is responsible for the development of health policy, operation of the nation's public health services, and management of the governmental health care budget. To support professional decision-making processes and policy management in radiology, the National Council of Radiology was established by the Ministry of Health. The government provides a standardized basket of medical services, including hospitalization, outpatient, and ambulatory health services, for all permanent residents of the country. The basket of services is reevaluated annually, and additions are made as deemed appropriate, within budget constraints, by the Ministry of Health.

The population and special circumstances in Israel offer unique research possibilities in the realm of radiology. Israel spends more than 5% of its gross national product on research and development. Research is funded through universities, through nation-

al and international competitive grants, and by industry.

The Israeli population is diverse and includes Jews of Asian, African, European, Russian, and North and South American origin and descent, as well as Arabs. The Israeli health care system also provides services for some complex patients from other nations under international agreements. This diverse, heterogeneous patient population exhibits a wide variety of genetic dispositions and diseases as well as a broad mix of communicable diseases. Israeli radiologists thus develop expertise in the diagnosis of a range of unique medical problems, such as familial Mediterranean fever, Gaucher's disease, and hydatid cysts [7–9].

Breast cancer is the most commonly diagnosed malignancy in the nation, with approximately 4,000 new cases per year (incidence of over 5.6 per 100,000) and more than 900 deaths [1]. The National Program for Early Detection of Breast Cancer monitors mammography services in Israel. More than 350,000 mammography studies are performed annually, and the number is increasing. National compliance with mammography screening programs is about 60%, with special efforts being made to reach socioeconomic groups in which compliance is lower. The increase in early detection of breast cancer due to screening mammography is expected to reduce breast cancer mortality by up to 30%.

Breast cancer gene (*BRCA*) mutations have a high prevalence among Jews of European descent, thus there is a relatively high percentage of *BRCA* genetic mutation carriers in the Israeli population [10]. Under guidelines established by the Israeli Ministry of Health, women known to be carriers and other young high-risk patients are screened with breast sonography and MRI.

Colorectal cancer is the second leading cause of death from cancer. CT colonography (CTC) was introduced in 1994, and more than 15,000 patients have been scanned in Israel using this technique. In the United Kingdom, which has a population 10 times that of Israel, approximately the same number of people have been studied using CTC. Insights into effective and safe scanning techniques have been gained as well as joint cooperation between the Israeli radiology and gastroenterology communities [11].

Beginning in 1909, low-dose irradiation of the scalp has been the worldwide standard of care for treatment of tinea capitis, a be-

nign fungal skin condition. Tinea capitis was epidemic among immigrants to Israel, and approximately 100,000–150,000 children were irradiated from 1940 to 1960. Seminal epidemiological studies published by physicians from Tel HaShomer Hospital–Tel Aviv University were instrumental in proving that irradiation of the head, even at relatively low doses, significantly increases the risk for meningioma [12, 13]. Significant experience in diagnosing and managing patients with radiation-induced meningioma, which is characterized by higher rates of multiplicity, more aggressive histopathology, and higher rates of recurrence, was gained in Israel [14].

Israel has gained considerable experience in imaging war and terrorism injuries. Owing to the overwhelming demands on limited resources after a terrorism attack and the complexity of injuries in many survivors, fast and accurate imaging plays an essential role in triage and identification of abnormalities associated with injuries. Radiologists have become a crucial part of the first-line team of doctors treating these patients [15].

Medical devices and pharmaceuticals have been produced in Israel for more than a century. The first Israeli pharmaceutical company was established in 1901. Elscint, founded in the mid 1970s, was a pioneer in CT development. The company made the breakthrough in MDCT acquisition (Twin CT, Elscint) as well as in the development of endocavity (endovaginal) ultrasound probe technology. In the 1990s, Elscint was purchased by major international imaging companies, but much of the knowledge, research, and production capacity remains in Israel.

The active Israeli high-technology sector continues to provide many opportunities for collaboration with the radiology community on medical imaging projects. The sector includes more than 750 life sciences companies, with approximately 50 new companies starting up each year. Among these, there are more than 100 companies and start-ups linked to various aspects of imaging, such as health IT (image management, teleradiology, and archiving), MRI, CT, sonography, and minimally invasive therapy applications. The radiology community in Israel has cooperated with companies developing a low-field intraoperative MR system, an MR-guided focused sonography system, a new technique using sound for chest imaging, hardware and software related to MDCT and coronary imaging, computer-assisted detection of suspicious

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findings in mammography and chest radiography, and more. The leading multinational imaging competitors, GE Healthcare, Philips Healthcare, and Siemens Medical Solutions, all maintain research and development facilities in Israel.

Just like Israel itself, radiology in Israel is multifaceted, based on traditional and profound knowledge combined with cutting-edge technology. The unique population and circumstances in Israel offer endless possibilities for radiologic research and development, and close international cooperation facilitates sharing of knowledge and experience with other countries.

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