



Nuclear Theranostics in Indonesia: Past, Present, and Future

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Abstract

Nuclear medicine in Indonesia has a quite long history since the late 1960s. There are some problems and obstacles that have to be solved and overcome in order to develop nuclear medicine services, spread the services to reach every target area, and implement new novel therapeutic nuclear medicine as well. The right strategy and strong effort should be performed for a successful result. Theranostics nuclear medicine will play a more prominent role in the management of cancer patients.

Keywords Indonesia · Nuclear medicine · Theranostics · Cancer

Past

Indonesia started its nuclear medicine services in 1971. It was Bandung Atomic Centre that put the first milestone with its TRIGA Mark reactor, but the first service performed at the health institution was carried out in 1971 in Hasan Sadikin hospital in Bandung, the teaching hospital for School of Medicine Padjadjaran University.

The first generation of nuclear medicine physicians had their educations, training, and courses abroad. They gave the services in big cities such as Bandung, Jakarta, Yogyakarta, and Malang.

¹³¹I therapy for thyroid cancer and also benign thyroid disease has also been performed since the 1970s to dozens of thousands of patients until now. This treatment has been more and more widely used on all patients coming from all over Indonesia to the nearest nuclear medicine centers.

One of the main constraints faced in developing nuclear medicine is nuclear phobia in the society including medical society. The history of two atomic bombings in Hiroshima and Nagasaki in 1945 which happened during the Japanese occupation in Indonesia made these events very attached to the Indonesian people. People had been very scared from the beginning to hear the word atom or nuclear.

Present

Since 1999, the education of nuclear medicine specialist has been started in the Department of Nuclear Medicine Hasan Sadikin Hospital/School of Medicine Padjadjaran University, Bandung. Until now, there are only a few nuclear medicine physicians (slightly above 50 in number) who have to cover more than 18,000 islands and more than 260,000,000 people [1].

While the first hybrid imaging system in the form of single-photon emission computed tomography/computed tomography (SPECT/CT) was initially installed in 2004, the first positron emission tomography/computed tomography (PET/CT) service was started in the late part of 2008 in a hospital in Jakarta followed by two other hospitals in 2011 and 2012. All of them are located in Jakarta, the capital city of Indonesia. In 2013, the PET/CT service was also carried out by a hospital in Bandung outside Jakarta. Besides fluorodeoxyglucose (FDG) PET, sometimes ¹⁸F-sodium fluoride (NaF) and ⁶⁸Ga dotatate PET/CT are performed.

The number of services has been increasing from year to year. From only several patients per week, now it can be up to dozens of studies per day in one hospital. The medical community is more aware of the use of nuclear medicine in diagnostic and therapeutic purposes nowadays. Another reason to the increase of demand of nuclear medicine services in Indonesia is the high cancer prevalence which was /347.792 people in 2013 [2].

The first nuclear medicine department in Kalimantan island has been opened which is located in Samarinda city. This occasion marked the beginning of 2018. This department will

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also have PET/CT services in the near future as the first PET/CT outside Java island.

Nowadays, ^{131}I for thyroid cancer is still the main theranostics service we perform. The other service is bone pain palliation therapy for osteoblastic metastatic bone disease and a small number of ^{131}I metaiodobenzylguanidine (MIBG) for neuroblastoma patients. The demand for those services is still increasing, especially the ^{131}I for differentiated thyroid cancer. This is caused by the increasing awareness of both the medical and general community about the benefits of radioactive properties, besides the relatively low number of nuclear medicine facilities compared to the number of population and islands in Indonesia.

This treatment has been showing its efficacy and gaining trustworthiness from other physicians and patients as well, which can be a good starting point for further theranostics services. For the preparation, a collaboration between Indonesian atomic agency (Batan Atom Nasional/BATAN) and our institution has been made to find out the biodistribution and dosimetry of prostate-specific membrane antigen (PSMA) labeled with ^{177}Lu for the management of metastatic castration-resistant prostate cancer.

Future

More hospitals realized the need of nuclear medicine procedures both in diagnostic and therapeutic aspects. It gets along with the increase of the number of residents. Almost 20 years ago, there were only 3 or 4 residents; now, the number increases to about 5-fold to almost 20 residents. This also increases the awareness to develop more centers of nuclear medicine education.

In the near future, the city of Samarinda will run the first PET/CT center in Kalimantan island followed by Solo in Central Java that will have the new nuclear medicine department equipped with PET/CT, cyclotron, SPECT/CT, and the novel therapeutic procedures as well. Some other cities will also follow in establishing theranostics nuclear medicine departments, such as Medan, Surabaya, Makassar, and Semarang. Hopefully, the spread of the nuclear medicine services will also reach the eastern parts of Indonesia. With some new PET/CT centers in several parts of Indonesia in the near future and some others within the next several years, the existence of novel theranostics services such as peptide receptor radionuclide therapy (PRRT) and PSMA radioligand therapy hopefully will be stimulated. The following years will be the milestone for the implementation of such promising theranostics services in Indonesia.

Facing the progress of nuclear medicine, the number of nuclear medicine physicians seems not enough. Every new department probably will only have 1 physician; even

currently, there is 1 physician that works in 2 departments in 2 different islands (Kalimantan and Sulawesi). One way to overcome this is by establishing connections between departments with high-speed networks that allow us to share cases, knowledge, and make virtual discussion. This network will enhance and accelerate the progress of nuclear medicine services.

A good multidisciplinary team approach (MDT) is mandatory for the success of patient management and the wide use of this novel theranostic approach [3]. By doing MDT, an initial approach and communication can be done to make other physicians aware and subsequently eager to refer their patients.

With the population of more than 260 million, the prevalence of cancers is higher than most other countries. This also happens in neuroendocrine tumor (NET) cases, which are apparently higher than currently known due to the lack of awareness and diagnostic modalities. By performing the ^{68}Ga somatostatin receptor PET/CT imaging, this iceberg phenomenon will be more uncovered resulting in early and more detection of this disease.

Conclusion

The right strategy and strong effort should be performed to develop nuclear medicine services to the next level. The success of this effort will make theranostics nuclear medicine play a very important role in the management of cancer patients and increasingly promote nuclear medicine as an independent clinical specialty.

Compliance with Ethical Standards

Conflict of Interest Hendra Budiawan declares that he has no conflict of interest.

Ethical Approval This article does not contain any studies with human participants or animals performed by the author.

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