

# Radiology Japan

Japan Industries Association of Radiological Systems

March 2005 No. 50

## Review of the Japanese Market for Diagnostic Imaging and Therapeutic Systems, the First Half Year 2004

*Diagnostic Imaging and Therapeutic Systems (production, exports, imports, domestic market)*

From January through June 2004 Unit: Millions of yen

Item	Category	Production		Exports		Imports		Domestic Market			
		Amount	% to Previous Year	Amount	% to Previous Year	Amount	% to Previous Year	Number of Units	% to Previous Year	Amount	% to Previous Year
<b>1 X-ray</b>		<b>59,569</b>	<b>110</b>	<b>17,405</b>	<b>104</b>	<b>11,472</b>	<b>121</b>	-	-	<b>53,636</b>	<b>115</b>
· General-purpose R/F		16,567	113	3,021	102	0	0	825	110	13,546	116
· Cardio & angio		6,230	119	2,284	83	5,547	108	132	85	9,493	125
· General-purpose radiography		10,444	83	3,735	105	648	95	2,090	93	7,356	76
· Mobile		1,279	57	550	38	101	64	312	85	830	86
· Dental		3,025	90	715	113	0	-	2,023	71	2,310	85
· Others		22,025	138	7,100	131	5,176	148	-	-	20,100	143
<b>2 CT</b>		<b>39,189</b>	<b>91</b>	<b>19,548</b>	<b>99</b>	<b>7,629</b>	<b>110</b>	<b>693</b>	<b>109</b>	<b>27,269</b>	<b>90</b>
<b>3 Nuclear medicine</b>		<b>3,569</b>	<b>230</b>	<b>27</b>	<b>71</b>	<b>4,909</b>	<b>102</b>	<b>134</b>	<b>100</b>	<b>8,450</b>	<b>134</b>
<b>4 MRI</b>		<b>17,977</b>	<b>104</b>	<b>10,844</b>	<b>116</b>	<b>15,345</b>	<b>82</b>	<b>215</b>	<b>82</b>	<b>22,478</b>	<b>84</b>
<b>5 Image processing systems</b>		<b>7,355</b>	<b>128</b>	<b>1,550</b>	<b>297</b>	<b>2,710</b>	<b>89</b>	-	-	<b>8,515</b>	<b>103</b>
<b>6 Related items &amp; accessories</b>		<b>13,443</b>	<b>96</b>	<b>5,264</b>	<b>101</b>	<b>2,140</b>	<b>200</b>	-	-	<b>10,319</b>	<b>105</b>
<b>7 Diagnostic ultrasound</b>		<b>38,015</b>	<b>103</b>	<b>24,642</b>	<b>101</b>	<b>4,773</b>	<b>100</b>	<b>3,504</b>	<b>111</b>	<b>18,146</b>	<b>105</b>
<b>8 Therapeutic systems</b>		<b>4,558</b>	<b>110</b>	<b>899</b>	<b>84</b>	<b>1,871</b>	<b>66</b>	<b>308</b>	<b>108</b>	<b>5,529</b>	<b>93</b>
<b>Total</b>		<b>183,675</b>	<b>104</b>	<b>80,180</b>	<b>104</b>	<b>50,848</b>	<b>98</b>	-	-	<b>154,343</b>	<b>102</b>

(Note 1) Domestic market: Calculated by the formula (Production - Exports + Imports).

### Review of the first half year 2004

( ) refers to increase or decline and percentage over the previous year.

1. The total count of medical imaging system of the first half of 2004 showed a slight increase in the domestic market.

- Production 183.7 billion yen (+6.6 billion yen, 104%)
- Export 80.2 billion yen (+2.9 billion yen, 104%)
- Import 50.8 billion yen (-1.0 billion yen, 98%)
- Domestic Market 154.3 billion yen (+2.7 billion yen, 102%)

2. The domestic market by major equipment showed:

- MRI: Amount 22.5 billion yen (-4.3 billion yen, 84%)  
Number of Units 215 units (-46 units, 82%)

They showed a decline in terms of both amount and the number of units. The decline has been obvious since April (64% by amount) when compared to the ending period from

January through March (101% by amount) of the fiscal year.

- Nuclear

Medicine	Amount	8.5 billion yen (+2.1 billion yen, 134%)
	Number of Units	134 units (±0 units, 100%)

PET, which holds the share of 52% out of the total amount of nuclear medicine equipments, showed a significant increase with the amount of 4.4 billion yen (+2.1 billion yen, 189%).

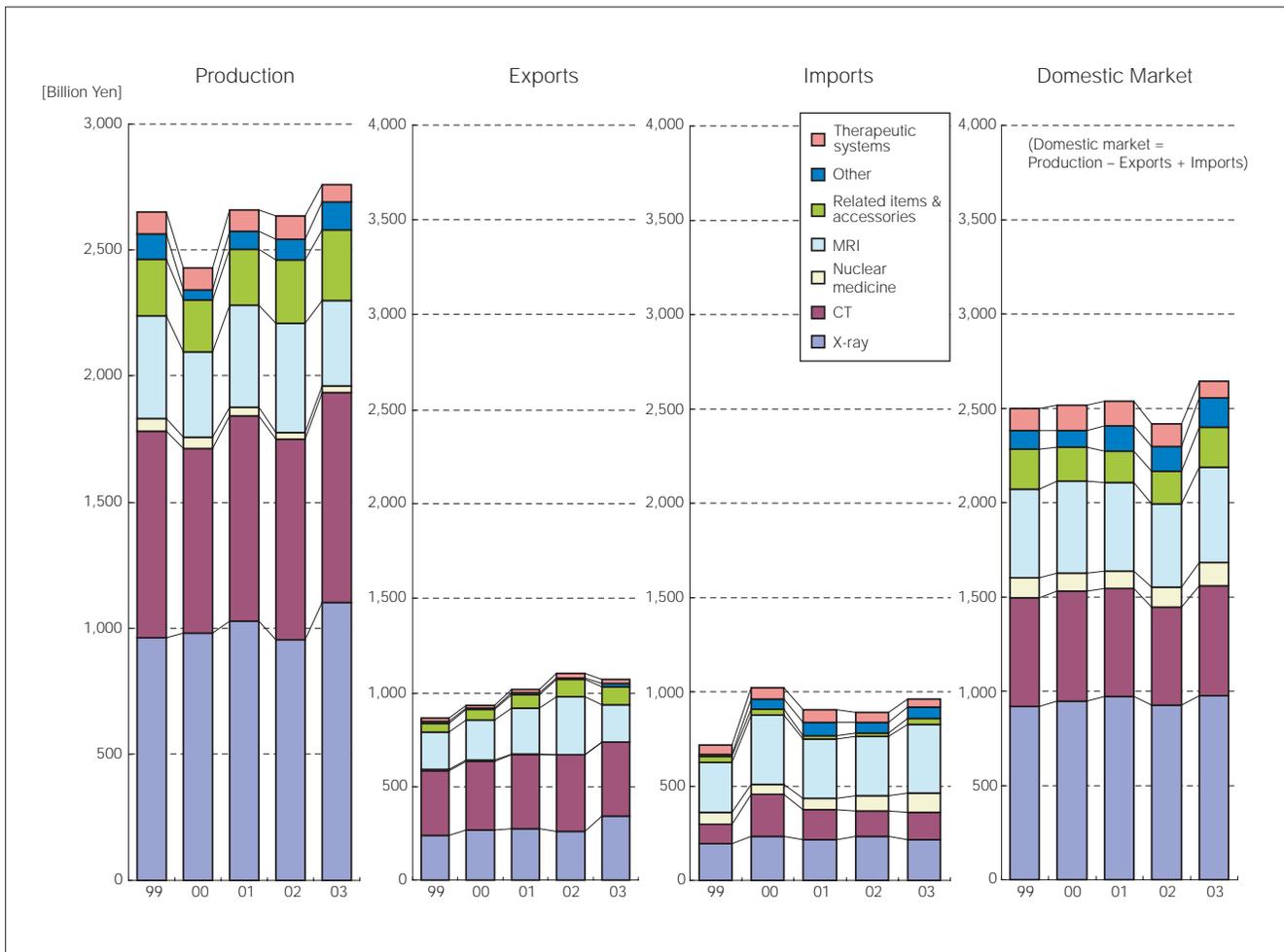
- CT Amount 27.3 billion yen (-3.2 billion yen, 90%)  
Number of Units 693 units (+59 units, 109%)

The number of units showed an increase although the amount showed a decline, which is presumably caused by demand's shifting to low-multislice CT, e.g. dual or four-slice, and a drop of retail price.

- Ultrasound Amount            18.1 billion yen  
    (+0.8 billion yen, 105%)  
    Number of Units    3,504 units  
    (+357 units, 111%)
- X-ray Amount                    53.6 billion yen  
    (+6.9 billion yen, 115%)

Among all diagnostic X-ray equipments, “Other types of X-ray equipments” showed an obvious increase (+6.0 billion yen, 143%) with the amount of 20.1 billion yen. Especially, “X-ray Data Processing Equipment” with the amount of 11.2 billion yen (+3.3 billion yen, 143%) and “Mammography Equipment” with the amount of 3.8 billion yen (+2.3 billion yen, 252%) showed a significant increase.

**Trends in Production, Exports, Imports, and Japanese Market for Medical Imaging and Therapeutic Systems [Revised]**  
**[Actual January-December figures for years 1999 to 2003] \* Excluding diagnostic ultrasound systems**



The association has organized the transitions of production, import & export, domestic market in the forms of tables and bar graphs based on the self-made yearly (January–December) statistics thanks to the cooperation of member companies. We have received an overall correction report every year since 2000, and therefore, we will report them once they are corrected.

# Outline of Revised Pharmaceutical Affairs Law (effective in April, 2005)

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The outline of this Revised Pharmaceutical Affairs Law intends to review the safety measures for medical devices under the progressing technology as well as the changing business conditions in order to achieve the proper authorization and certification system based on the reinforcement of post-marketing safety and international coherence.

## 1) Risk-based Classification

In general medical devices are state of the art and global products, JMDN (Japan Medical Device Nomenclature), a set of general terms of medical devices in Japan, was defined based on the risks described in the proposal "Classification of Medical Devices" by GHTF (Global Harmonization Task Force.) According to the risk classification, risky Class III and IV are referred as specially controlled medical devices, Class II as controlled medical devices and Class I as general medical devices.

## 2) Review of Authorization System

Requirements for medical devices were established and regarded as fundamental items for examining authorization (17 items).

Regarding authorization of medical devices, specially controlled medical devices shall be authorized by the Pharmaceuticals and Medical Devices Agency and controlled medical devices shall be certified by third-party certification bodies, and general medical devices require self-certification.

## 3) Establishment of Marketing Business

In order to clarify corporate responsibilities against the market and to liberalize outsourcing of manufacturing process completely, marketing business was newly established by redefining manufacturing authorization as marketing authorization through distinguishing manufactur-

ing process from placing on the market process. Marketing business is essentially required to place three supervisors: Marketing supervisor-general, Quality assurance supervisor, and Safety supervisor so that quality control of medical devices for manufacturing & distribution will be performed and post-marketing measures will be exercised. In addition, requirements such as academic background, working experience, expertise, etc. were added to qualify a marketing supervisor-general.

## 4) Reinforcement of Post-marketing Safety

Specially designated maintenance management required medical devices were defined as medical devices which require expertise and skill for maintenance and repair. Retail business and rental business, which deal with these specially designated maintenance management required medical devices as well as specially controlled medical devices, are required to obtain approval instead of traditional notification upon retail, rental and providing medical devices. In dealing with only controlled medical devices, notification is required as before.

## 5) Independence of Repair Business

Repairing medical devices was reviewed as well, and it is now regarded as an independent business instead of part of traditional manufacturing business. In addition, two cases were defined depending on the medical devices to deal with: a case for dealing with specially designated maintenance management required medical devices and another case for dealing with the rest of medical devices.

## 6) Implementation of Quality Management System in accordance with International Standards

As for manufacturing business, a quality management system in accordance with ISO13485 was implemented.

# JIRA Activity Reports

## Additional Study of Korean Medical Equipment Law and Meetings with Korean Medical Equipment Associations

In July 2004, JIRA International Division visited Korea to perform an additional study of Korean Medical Equipment Law implemented in May 2004 as well as to exchange information with 4 medical equipment related organizations in Korea: Korean Food and Drug Administration (KFDA,) Korea Testing Laboratory (KTL,) Korea Medical Devices Industry Association (KMDIA,) and Korea Medical Devices Industrial Cooperative Association (KMDICA). The followings are the reports about these meetings.

### 1. Korea Medical Devices Industrial Cooperative Association (KMDICA)

- 1) KMDICA is an association that is approved by Ministry of Health and Welfare and is supported by Middle and Small Companies Fosterage Law. The association organizes statistical data of domestically-produced medical equipments, which covers approximately 80% of the turnover of domestic manufacturers.
- 2) Market Trend;
  - Import has increased by 10% and the import of expensive high-tech medical equipments, which cannot be produced domestically, is growing.
  - Home care products (healthcare medical equipments, obesity equipments, etc.) are growing while their domestic production sees sluggish growth.
- 3) Affects by Implementation of Medical Equipment Law
  - KGMP (Korean GMP) has become compulsory, but GMP has not yet been perceived widely among manufacturers in Korea. In order to spread KGMP, both KFDA and KMDICA are holding workshops to enlighten them.
  - GMP is expected to be performed in three years as companies incapable of implementing KGMP are gradually disappearing.
- 4) PACS was concluded as medical equipment.
  - The lawsuit was caused by the case where a PACS manufacturer and distributing company received penalty charge from the administration. The company left the registration about PACS as it was (medical equipment) instead of filing an application about alterations as personal computers were improved. Responding to this penalty charge, the PACS vendor filed a lawsuit against the administration based on the rational that personal computers, which are being improved constantly, are different from medical equipments.



Meeting with KMDICA

### 2. Korea Medical Devices Industry Association (KMDIA)

- 1) KMDIA is an association (non-profit) authorized by KFDA. The association composes production and import data of medical equipments in Korea and has a reporting duty to the administration.
- 2) KMDIA is exercising the duty authorized by the government.
  - Reporting schedule about standard customs clearing (EDI) → Ministry of Commerce, Industry and Energy
  - Recommendation of items which are difficult to be produced domestically → Ministry of Health and Welfare
  - Reporting actual production performance → KFDA
  - Consolidating and analyzing statistical data (including import and export) → KFDA
  - Conducting assignments for governmental research (3 assignments in 2004)
  - There is a plan of operating "Preliminary PR Examination Committee" after the announcement of regulations with regard to the implementation of Korean medical equipment law.
- 3) Korean Market Trend
  - The medical equipment market in Korea is expanding with the amount of 2,660 billion won (2,280 million USD) in fiscal 2003. The actual amount, which includes distribution margin, is twice or more the above amount.
  - The simple ratio between domestic production amount and import amount is 50:50.
  - PACS market has decreased: It is why PACS have been distributed to almost all hospitals.
- 4) Affects by Implementation of medical equipment law;
  - Implementing KGMP within 3 years has become compulsory for domestic manufacturers. So, it is expected that international competitiveness through quality

improvement will be reinforced while companies incapable of implementing KGMP will disappear.

- It is anticipated that the implementation of import authorization system in Korea will produce new big import companies through M & A among middle and small-sized companies.
  - It is expected that the system of repair and leasing businesses will lead to the improvement of both post-marketing management and quality in overall medical equipment fields.
- 5) KMDIA Action Policy
- Holding explanatory meetings regarding regulations about implementing medical equipment law.
  - Performing PR activities to publicize sub content regulations of medical equipment law.
  - Operating the preliminary PR examination committee of medical equipment.
  - Organizing opinions from member companies through receptions, seminars, workshops, etc. by subcommittees, and providing KFDA with proposals reflecting the ideas of the industry.
  - Providing KFDA with proposals for revision about an unsatisfactory part of lower regulations of medical equipment law.



Meeting with KMDIA

### 3. Korean Food and Drug Administration (KFDA)

#### 3.1 Department of Medical Equipment at Safety Bureau

- 1) Affects by implementation of medical equipment law
  - Medical equipment law was established on May 29, 2003 and implemented on May 30, 2004. This law conforms with GHTF movement and puts emphasis on quality improvement and post-marketing management.
  - It is desired that medical equipment quality control will be improved by actively making KGMP compulsory.
  - Implementing GMP is the first-time attempt in Korea. Currently, only 17 out of more than 1600 manufacturers in Korea have obtained GMP.
  - According to some opinions, the 3-year grace period for

GMP implementation appears too short. However, the foundation for GMP implementation is already established, because approximately 200 companies have already obtained European CE mark (ISO 13485).

- 2) Information about joint planning of medical equipment among Korea, Japan and China has been received recently. This should be desirably carried forward, since the Korean government is very interested in it.
- 3) Improving medical equipment administration will be focused with Japan (e.g. Pharmaceuticals and Medical Devices Agency) as its model. In order to achieve the goal, cooperation from JIRA is strongly desired.



Meeting at KFDA in the department of medical equipment at Safety Bureau

#### 3.2 Department of Medical Equipment Evaluation at KFDA

- 1) The department evaluates medical equipment based on Korean medical equipment law and prepares quality standards.
  - KFDA (Department of medical equipment evaluation) will remain an important organization for JIRA to interact with.
- 2) The department organizes testing facilities in Korea (GMP testing facilities, technical testing facilities.)
  - GMP testing facilities: 4
  - Technical testing facilities: 9 (KTL, Chemical testing laboratory, 2 dental laboratories, others)
- 3) Explanation about Japanese revised Pharmaceutical Affairs Law was requested. (Appointment of re-visit in March, 2005)



Meeting at KFDA in the department of medical equipment evaluation

#### 4. Korea Testing Laboratory (KTL)

- 1) The team of medical equipment division consists of 40 people (50 when students are included.)
  - Medical equipment team (17 people): Testing and inspecting all medical equipments except for laser and X-ray equipments
  - X-Ray equipment team (10 people): Testing and inspecting laser and X-ray equipments
  - Investigation team (8 people): GMP examination (Factory examination.) The team name is desirably changed to examination (assessment) team.
  - Quality standard team (7 people): Examining technical documents such as "Technical Document" in medical equipment law, whose name was changed from "Standards and Testing Methods" in the former Drug Legislation
- 2) 15 guidelines about implementation regulations are scheduled to be issued by September 2004. The following three of all are main important provisions.
  - Classification of medical equipments: Issued in the middle of August, 2004
  - Authorization of medical equipments: In the public comment; <http://www.ktl.re.kr/eng/>
  - Examination of medical equipment technical documents: In the public comment: <http://www.ktl.re.kr/eng/>



Meeting at KTL

#### Study of Chinese Legislation systems and Meeting with Related Agencies

On July 1, 2004 in China, "Administrative Licensing Law" was implemented. This law prohibits regulation enactment, promulgation, implementation and alteration by respective administrative department, and requires permission from State Council instead. From September 12 through 17 in 2004, JIRA International Division dispatched a mission to China to study how "Administrative Licensing Law" affects medical equipment related regulations in China, especially about Chinese medical equipment management ordinances as well as alterations of China Compulsory Certificate (CCC) safe quality authorization system and to interact with Chinese medical equipment related organizations.

##### 1. Meetings with China Association for Medical Devices Industry (CAMDI)

JIRA had a meeting independently with CAMDI for the first time. CAMDI plays a substantial role as an information source for obtaining information regarding medical equipment in China (regulations, market data, etc.) as the organization is expected to participate in planning regulations for medical equipment in China.

- 1) CAMDI Governing Structure
  - Established as a corporate aggregate by the authorization from Ministry of Civil Affairs in 1991.
  - 23 members of secretariat
  - Supervised by State Food & Drug Administration (SFDA)
- 2) Number of Member Companies
  - Direct Members (First-class members): Approximately 600 mostly large-sized manufacturers
  - Indirect Members (Second-class members): 3000-4000 companies
- 3) Description of CAMDI Business
  - Organizing medical equipment exhibitions and planning missions to overseas exhibitions and conducting workshops
  - Participating in planning regulations by State Food and Drug Administration (SFDA) and performing PR activities for these regulations.
  - Developing education for prevention of law violation (Conformity, Publicity)
  - Interacting with FDA in America, MDD in Europe and the neighboring countries such as Taiwan, Hong Kong, Korea, Japan (Japan Federation of Medical Devices Associations) and Singapore
  - The organization is now planning "OEM Parts Exhibition" for medical equipment in Shenzhen in September 2005 (Participation of approximately 300 companies is expected.)

Type of diagnostic imaging equipment	Total number of Shipment	Shipment (2003)	Yearly growth rate
Ultrasound Equipment (monochrome)	30,000 sets	1,500 to 2,000 sets	10 to 15 %
Ultrasound Equipment (color)	8,000 sets	900 sets	15 % and over
X-ray Generator (including mammography)	30,000 sets	1,000 to 2,000 sets	-
X-ray CT Equipment	5,000 sets	630 sets	10 % and over
MRI Equipment	1,100 sets	300 sets	-

#### 4) Medical Equipment Market Data in China

- SFDA keeps the market data of medical equipment in China under control, and no statistics report has been disclosed in public.
- The following are the statistical figures about diagnostic imaging equipment provided by CAMDI.

#### 5) Alterations of Medical Appliances Registration Law associated with "Administrative Licensing Law"

"Administrative Licensing Law" was published in August 2003 and implemented on July 1, 2004.

According to the "Administrative Licensing Law," regulations related to medical equipments were altered and medical equipment registration system, etc. was partly mitigated. (Refer the part of exchange with SFDA for details.)

#### 6) Movement to EMC Regulations for Medical Equipment

A draft of EMC for medical equipment has been completed and is now under examination by the State Standard Committee.

The regulations are expected to be published sometime between half a year and two years after the examination is completed in about three months.

#### 7) The Second Korean/Japanese/Chinese Medical Equipment Industry Conference

Intention of holding the conference in Shenzhen, where OEM Parts Exhibition will be held in September 2005 for the first time in China, was shown.

## 2. Interaction with Certification and Accreditation Administration of the People's Republic of China (CNCA)

### 1) New China Compulsory Certificate Scheme (CCC Mark)

- There are no changes associated with "Administrative Licensing Law" with regard to handling of medical equipments examined by new China Compulsory Certificate Scheme (CCC mark)
- There are no changes regarding medical equipments on the list of items for certification.
- The following are the points to be checked with regard to certification system, testing, etc.

a. Certification is given to a whole system, and therefore, each unit need not apply for certification unless it is on the list for safety quality certification.

b. Items which should be described in Chinese on system plates are defined in "Product Quality and Quantity Regulations (Article 15.)"

Items which require description in Chinese are the following three: 1. Product name (including system name) 2. Manufacturer name 3. Address of Manufacturer

c. Product registration certification by State Food and Drug Administration (SFDA) and new China Compulsory certification (CCC mark) cannot be unified.

Certifying medical equipments safety is performed with China Quality Certification Center (CQC) as the key player as before, and testing is performed at laboratories in Shen Yang.

d. Promoting "self-certification" by each company (Currently, examinations with X-ray tubes and high-voltage generator assembly are conducted.)



Meeting of JIRA & CAMDI



Meeting of JIRA & CNCA

### 3. Interactions with China Quality Certification Center (CQC)

- 1) CQC Reorganization and Personnel Changes
  - More departments were established due to the increase of the certification items subjected, including interior decoration, lacquer, flooring materials, etc.
  - There were no changes in personnel of medical equipment certification department.
- 2) China Compulsory Certificate Scheme (CCC Mark)
  - There are no changes for China Compulsory Certificate Scheme associated with "Administrative Licensing Law".
  - Issuing a new standard applying to the X-ray diagnostic equipments and diagnostic ultrasound equipments has been neither determined nor planned for the time being.
  - China has not made an entry for CB scheme. CB scheme is used just for reference, but is not planned to be employed.
  - Regarding maintenance parts for products which are not subjects for CCC can clear through customs when an application is filed to CNCA.
  - When control of products certified by CCC mark is transferred to a production facility in China, actual product examination can be exempted if parts used, including raw materials, remain identical.



Meeting of JIRA & CQC

### 4. Meeting with International Health Exchange Center, Ministry of Health, P.R. China (MOH)

Information about medical administration in China was collected from Director of Dept. of Planning & Finance and Director of Dept. of Convention & Exhibition.

- 1) Plan for healthcare improvement in rural area
  - The government has been continuously providing monetary and human resources for healthcare in rural area.
- 2) Installment plan of medical equipments in 2004
  - The plan from 2004 through 2006 is being composed currently.

The legal depreciation period for large electric medical equipments, such as CT and MRI, is defined as 6-8 years.

Expensive equipments such as CT and MRI are likely to be upgraded in most cases in the future.

For example, there is demand of upgrading 400-500 out of 4000-5000 CT sets in installation currently. (Upgrading 10% and over on a yearly basis is planned.)

- 3) Diffusion of X-ray equipments in rural area
  - Healthcare level in rural area is classified into three: hsien, county and rural medical office.
    - a. At the hsien level, X-ray equipments are adopted by 100%. CT sets are also prevalent.
    - b. At the county level, X-ray equipments are adopted by 80% (However, many of the equipments are old and of low-level.)

Fund for purchasing equipments will be supported.
    - c. At medical offices in rural area, no X-ray equipments are installed as X-ray equipments are considered to have no necessity there.

There is no difference between hospitals in urban area and those in rural area. General hospitals are classified from Class 1 to Class 3. (Hospitals at the hsien level and in rural area are classified mostly as Class 2.)
- 4) Diffusion of high-technology imaging diagnostic equipments in China
  - 500 MRI sets or more are installed nationwide.
  - PACS is considered in the scope of information control system, instead of medical equipment. (Department of management is located in Information Control Center of Ministry of Health.)

There still remain a number of problems with regard to hardware. Purchase of new equipment is left in the hands of individual hospital, depending on the necessity. Ministry of Health does not regard it as medical equipment, and therefore, the installation is not included in the state's implementation plan.
- 5) Health insurance program in China
  - No significant change is observed in health insurance program as a whole.
  - In rural area, development of "Collaborative Healthcare in rural area," which is implemented in 300 hsiens in China, is discontinued. This will migrate to a new type of collaborate healthcare system for the future.

A new type of health insurance program for developing medical services is being sought based on the funding from government, groups and individuals with the intention of nationwide development.
- 6) Affects by the enactment of "Administrative Licensing Law" to medical administration in China
  - No specific change is observed regarding medical administration by Ministry of Health.
  - Authorization regarding installment of expensive medical equipments has been provided by Ministry of Health, which believes that prevention of excessive

investment of medical equipments will be eventually beneficial to citizens.

#### 7) Health checkup program in China

- The state provides opportunities of annual health checkup to citizens.

The health system provides opportunities of physical examination as well, but they are optional instead of compulsory.

- a. The government does not provide support actively.
- b. Regular health checkup is not almost performed in rural area
- c. Those with economic power are interested in health checkup, which results in an increase in demand.
- d. Some of the hospitals are dedicated to health checkup program.



Meeting of JIRA & MOH

### 5. Meetings with State Food & Drug Administration (SFDA)

#### 1) Newly-issued Regulations, Notification, Standards, etc.

- “Administrative Licensing Law” is issued against respective administrative body and clarifies the jurisdiction right by State Council.

Regulations, notifications and standards, which have not been authorized by State Council, shall be either altered or abolished.

- Restrictions consist of four steps: Law (criminal law, drug act, etc.) legislation (authorized by State Council,) department regulations (management method is regulated,) standard documents (documents with red stamp)
- Revised legislation
  - a. Medical appliances registration (Control of medical appliances) published in September 1996 (State Pharmaceutical Administration of China), The third alteration, State Food and Drug Administration
  - b. Management of manufacturers (Control of medical equipment) Management of medical appliances production control
  - c. Management of managing companies registration (Surveying market control)

d. Operation manual and displaying method (Control of medical equipment) Article No.30 by State Drug Administration in 2002. This operation manual, labeling and packaging were published as Article No. 10.

#### e. Related regulations

- Clinical Test Regulations were newly published in 2004. No regulations at this level had existed.

#### 2) Alterations of medical equipment registration

- “Restrictions regarding production” was excluded.
- Clinical testing was relaxed. Clinical testing was required for products in “category 2 and above,” which is no longer necessary when similar products are already found in the Chinese market after the revision. This is still required for products in “category 3.”
- Registration for test production of domestic products was abolished.
- As for renewing registration, “2001 Compliment Regulation” was issued against imported products, which resulted in the exemption of examination for unchanged actual equipment containing an operation manual. This time, this is applied to domestic products, and the actual equipment examination is also exempted.

As conditions for application, actual equipment examination is exempted after examination report for authorization is evaluated and is found to contain no changes.

Report composed by companies on their own is also acceptable.

#### • Procedures for Registration

Standard examination period is defined and is released.

A committee for solving special situation was placed. The examination period by this committee is excluded from the pre-defined examination period.

Procedures for registering imported products are completed within 90 days.

#### 3) “Clinical Testing Regulations” (Published in March and Implemented in April, 2004)

This applies to clinical testing performed in China. The overview is as follows.

- Clinical testing cannot take medical treatment fee.
- Information about the number of cases is a fundamental requirement. (Procedures: Concluding a contract with a hospital, planning clinical testing, filing an application, and inviting examiners, who evaluate the result and determine the suitability.)
- The existing regulations allowed companies to choose clinical testing facilities from province level 2 and from hsen level 2. However, after the revision, companies are required to choose facilities among the hospitals (base for pharmaceutical hospital) designated by the state.
- Planning of clinical testing shall be consulted with facili-

ties (hospitals) and the testing shall be performed with companies' responsibilities.

- Submitted clinical testing reports are examined by experts.
- 4) "Registration Management Ordinances" (Implemented on August 23, 2004)
- Preliminary examination of "standard document of product" is no longer required. Certifying products by companies is now approved, which results in reducing the period for registering products by about a month.
  - Independent examination of "operation manual" is no longer required. This document can be submitted together with "standard document of product."
  - Applicants (legal representatives) shall have legal knowledge as well as product knowledge. Legal responsibilities of applicants shall be clarified.
  - Assigning legal representatives by international companies, etc. requires letters of procuracy. Committed parties are required to issue letters of acceptance.
  - Registration system for test production of domestic products is abolished.
  - When imported goods are switched to be produced in China, including cases of control transfer to joint companies and such, type test, clinical testing and actual equipment examination for products with no specification changes, are now exempted



Meeting of JIRA & SFDA

# Development of Japanese Radiological Equipment in the Post-World War II Period (15)

## Development of radioisotope (RI) Cobalt (therapy equipment) etc.

Sumio Makino  
Advisor, JIRA



### 1. Budding years of RI application in Japan

Use of a large quantity of RI Cobalt to remote-controlled therapy was a ray of hope in Japan, because the radiation-induced skin ulcer had been a big problem in X-ray therapy for many years. At that time, nobody knew anything about Cobalt. In this situation, Cobalt therapy was introduced with continuation of serious episodes, which would now be a funny story. It was something like the civilization and enlightenment in the Meiji Era of Japanese history.

This article records such episodes in which I was involved then myself.

First of all, the detailed description in the historical document of Japan Radioisotope Association is excerpted below.

#### *A large quantity of Cobalt 60 source*

*Mass production of Cobalt 60 source was started by the atomic reactor in Chalk River, Canada. The potentiality led to invention and installation of remote-controlled Cobalt irradiator in Canada and the United States. The first installation in the world was Brit. Columbia Hospital, Vancouver in August 1951, followed by Oak Ridge Medical Division in October 1952.*

*The information reached our country early. In 1951, an expert committee was formed under the therapy research group of Ministry of Education. This committee was chaired by Masanori Nakaizumi (Chair Professor, Department of Radiology, Faculty of Medicine, The University of Tokyo, 1895~1977). The members included Tsukamoto (Director, Department of Radiology, Cancer Research Institute Hospital, 1904~1974), Miwa (University of Education), Yamashita (Department of Radiology, School of Medicine, Keio University, 1910~), Eto (Physics, Department of Radiology, Faculty of Medicine, The University of Tokyo, 1911~1983), Kakei (ditto, former lecturer, 1910~1991), Nishibori (Toshiba Fuji Works), Makino (ditto), and Fujimoto (Shimadzu Corp.). (They are all mentioned with the then titles). In the meantime, much information reached Japan in foreign technical literature. Yamashita, who happened to be in the United States, had a chance of seeing the equipment under construction at GE Milwaukee Plant that was destined for Oak Ridge Hospital. As a result, Tokyo Shibaura*

*Electric Co., Ltd. (now Toshiba Corp.) manufactured type I and type II equipment for the first time. Type II was exhibited at the Congress Meeting in Osaka in 1953. Type I equipment was completed around June and was installed at National Tokyo Daini Hospital in October in the same year. Type II equipment was installed at the University of Tokyo around the same time. The first Cobalt 60 source imported consisted of disks of 1 cm in diameter and 2 mm in thickness, and 172 Ci were imported in September 1953. One piece was 7 Ci, and three pieces were assembled in a cloverleaf shape with 21 Ci in total. Type I and type II were designed to house 100 Ci and 50 Ci, respectively. But, the imported quantity was small in the early days. So, The University of Tokyo, National Tokyo Daini Hospital and Kyushu University used 21 Ci each. The quantity was too small for full-scale research, but it was better for safety of operation. In the meantime, we had several episodes.*

Thus, the remote-controlled Cobalt 60 irradiator was introduced though not quite satisfactorily. As mentioned above, we had several episodes, which I believe describe the history of development itself. As a survivor involved, I mention their real names of people concerned in these episodes. The readers are requested to consider this article as mere episodes and to excuse me for impoliteness if any. (Their honorific titles are omitted in this article.)

### 2. Several episodes about the early days of development of Cobalt 60 remote-controlled therapy equipment

#### 2-1. What is a radioisotope? What is a Cobalt source?

In 1951, I was ordered to participate in the development project team chaired by Nakaizumi under Ministry of Education. The superior of mine, Kiyomi Nishibori (Medical Equipment Engineering Section, Deputy Section Manager), was a formal team member from Toshiba. Maybe I was appointed as assistant.

My questions to my boss were, "What is a radioisotope? What is a Cobalt source?" I looked for information in the textbooks of physics and chemistry that I used in my school days.

The pre-war curriculum did not explain anything about RI. I found only a line or two about the definition of RI, and nothing more. The textbooks did not mention even basic knowledge that was required for participation in the special team of Ministry of Education. It was a matter of course that my questions were not answered by Mr. Nishibori who graduated during the war. Finally, both of us agreed that we would learn more about RI through participation in the team.

## 2-2. Start of expert committee under Nakaizumi research group

The expert committee was formed by many scholars and researchers mentioned above. Hisao Yamashita brought home from the U.S. the document of Cobalt remote-controlled therapy equipment named “El dorado”. It was a voluminous instruction manual issued by the Canadian Atomic Energy Research Institute etc. The first task of the team was interpretation and analysis of this only document available. Finally, it was decided to start to design prototype equipment after understanding explanation described in these documents. The task was assigned to the author, the youngest member of the team. As a result, the author is later referred to as an authoritative specialist on Cobalt remote-controlled therapy equipment in Japan. At the beginning, however, the author was a mere layman asking the question, “What is a radioisotope?” This process seems to me to show how something innovative is developed.

## 2-3. The chairperson thundered out rejection to our proposal, saying that Japan is a poor country.

“I cannot accept the proposed design of luxurious equipment. You must redesign it.” As mentioned above, the members of expert committee carefully interpreted and analyzed the related documents, studied how to design the remote-controlled therapy equipment for 100 Ci for several months, and finally completed the design concept of irradiator head (Figure 1), which was adopted for type I equipment. All the members expected that this design concept would be admired by the chairperson. Thus, it was submitted by Kakehi, assistant professor of the University of Tokyo.

On the contrary, the concept by Nakaizumi who was born in the Meiji Era of simplicity and fortitude was quite different from the proposed one. Nakaizumi said, “You know that the gamma ray is emitted from the Cobalt source in all directions. I cannot

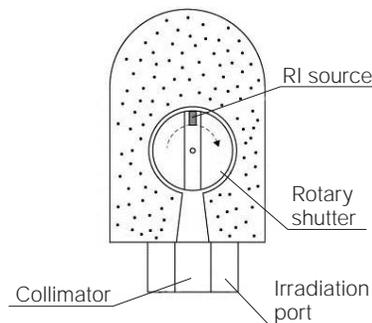


Figure 1. Schematic diagram of irradiator head of type I remote-controlled therapy equipment

accept your proposal. Japan is a poor country. I cannot accept the wasteful equipment that can use only one direction of gamma ray emission. You must invent the equipment that can use simultaneously more than one direction of emission. You must redesign it!”

Far from being admired, all the members were scolded. Their study and design efforts for several months ended in midair. They shrugged their shoulders and were quite at a loss what to do next.

## 3. Design and manufacture of multi-portal Cobalt therapy equipment

After being scolded by Nakaizumi, the members shelved the single-port design and started rapidly to design the multi-portal design. The task was totally assigned to me. I returned to Fuji Works and submitted several “tentative” design concepts after consultation with design engineers.

I happened to recall a cartoon character. It is a ball with many ports on its surface through which the head and limbs come out for quarrels and other activities. It was not practical to have so many ports like the cartoon. So, I submitted the design drawing for 3-port type and 2-port type to the committee.

Anyway, the design of more than one port makes radiation shielding more difficult. After deliberation by the committee, multiple ports ended in at most two ports, which was approved for a prototype by the chairperson. This was the start of development of type II (Figure 2).

Type II was so designed to be fully suitable for installation in hospitals in Japan, a poor country. The irradiator head was hung with the bent iron bars, and installed in the irradiation room without further construction work. The source shutter was opened or closed manually from outside the irradiation room by using a remote-controlled wire mechanism.

- Here is another episode, “Cobalt Tagonoura Incident”, which is mentioned also by Hirotake Kakehi in an episode in “Ten-year history of RI development” issued by Japan Radioisotope Association.

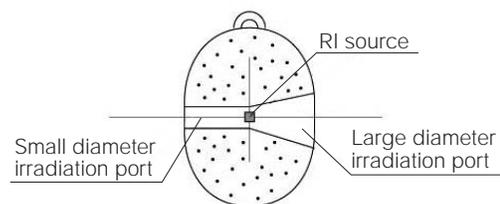


Figure 2. Schematic diagram of irradiator head of type II remote-controlled therapy equipment

In response to the chairperson's intention, we decided to manufacture type II first before type I whose design policy had been decided already. An order for a prototype was given to Toshiba Fuji Works around April 1952.

Although construction seemed to be relatively simple on a drawing, it was actually a difficult task. A container of 50 Ci of Cobalt was a sphere of about 40 cm in diameter. The sphere was made of lead cast material and it required internal cutting operation. Because of the limited level of in-house engineering and experience available at that time, manufacture was subcontracted to a specialized company located in Tokyo-Yokohama area.

In June, the prototype was completed as the first Cobalt therapy equipment in Japan. The committee members received the long-awaited notice, leaving Tokyo in a great expectation early in the morning for Fuji Works.

– In those days, it took about three hours and a half by train to travel from Tokyo to Fuji City, with steam locomotives running from Numazu to Fuji. It was not an easy trip with the notorious Hakone mountainous area located in between. (The telephone communication with Tokyo was difficult, too. It was available only once a day, during lunchtime, while most companies did not use telephones and the lines were less congested.) –

With the level of manufacturing technology at that time, even the specialized subcontractor had difficulty in large lead casting and machining. The prototype was scheduled to be transported to Fuji Works for assembly one day before the visit of the committee members. The prototype did not come as scheduled. Everybody of the Works including General Manager was quite at a loss in keeping the distinguished guests from Tokyo waiting for a long time. Nowadays it would be easy to telephone the subcontractor, but at that time it was impossible because of poor telephone communication in Fuji area!

Senior managers of the Works were unable to understand the reason of delay, because of difficulty in telephone communication. The guests who arrived in the morning were wined and dined around noon. Finally in the afternoon, senior managers instructed the author to take the guests to Tagonoura, a scenic beach near the Works, and show them a shore seine or something to kill time. Maybe it was not a harvest season and the famous “Tagonoura” was a mere deserted beach.

“The delay is probably due to difficult transportation through the notorious Hakone mountainous area.” Hearing such an excuse, the party returned to the Works and was wined again in the guest room.

“Mr. Makino, I'm drunken,” said to me hesitantly Dr. Eto, who was liquorish. “Are you really ready to show it today?!”. “If I returned to Tokyo without inspecting the machine, it would be a scandal.” Dr. Eto's comment to me was frank and jokey. Although other guests were irritated by the delay, they must have hesitated to ask a harsh question after seeing the Works staff having a hectic time all day long.

At last in the evening when the guests were about to leave the Works to catch a train for Tokyo, the assemblymen told us to come to see the prototype. The Works staff worried very much that hasty assembly in a short time would cause any serious trouble in trial operation of the prototype. They instructed me secretly to go the long way around in a general guided tour in the Works and to gain time as long as possible before the guests reached the assembly site.

As instructed, I took the guests taking time to the site where the prototype was assembled. It was already evening. (Figure 3)

The trial operation ended successfully. A guide said to the guests, “Now it is time for you to return to Tokyo”, trying to distance them from the assembly site, where they stayed for only about five minutes. I was told later as follows. Whenever the machine was operated by the guests, the assemblymen were wiping cold sweat on the forehead, fearing possible malfunction of the irradiator. They received it only a few hours ago and did not have enough time to check it before hasty assembly.

The guests left Tokyo in the morning, waited all day long and finally returned home after inspecting the machine for only about five minutes. They must have been much disappointed and disgusted. Whenever they happened to meet me after this incident, they used to refer to it. This episode was recorded as “the Cobalt Tagonoura Incident” by people concerned in the academic circles who heard the news. It remained as a topic of conversation for some time.

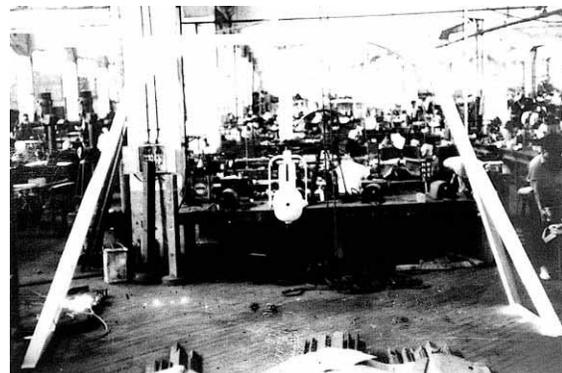


Figure 3. Type II irradiator under tentative assembly at Fuji Works (1952)

#### 4. Summary of this article

The author wanted to leave the record of Cobalt therapy that was introduced in Japan. As far as people involved as a manufacturing company are concerned, I am an only survivor now. I recorded my memory as comprehensively as possible, resulting in slightly repetitious explanation. Such kinds of episodes are quite common when something innovative is introduced. I hope that this article serves as a historical record for introduction of Cobalt therapy in Japan.

The next article will deal with the early days of Cobalt therapy, the details of equipment, the market development etc.