JIRA

Radiology Japan

Japan Industries Association of Radiological Systems March 2006 No. 52

Review of the Japanese Market for Diagnostic Imaging and Therapeutic Systems, the First Half Year 2005

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

From January through June 2005 Unit: Millions of yen

Category / Item	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
1 X-ray	**62,784**	**105**	**20,346**	**117**	**14,066**	**123**	**–**	**–**	**56,504**	**105**
· General-purpose R/F	16,074	97	2,669	88	28	–	766	93	13,433	99
· Cardio & angio	6,178	99	2,533	111	8,047	145	141	107	11,692	123
· General-purpose radiography	8,435	81	4,675	125	1,045	161	2,659	127	4,805	65
· Mobile	1,906	149	1,000	182	74	73	397	127	979	118
· Dental	3,145	104	1,044	146	0	–	1,967	97	2,101	91
· Others	27,045	123	8,424	119	4,873	94	–	–	23,494	117
2 CT	**49,694**	**127**	**28,497**	**146**	**8,506**	**111**	**701**	**101**	**29,702**	**109**
3 Nuclear medicine	**2,556**	**72**	**0**	**0**	**8,954**	**182**	**111**	**83**	**11,510**	**136**
4 MRI	**19,001**	**106**	**9,581**	**88**	**20,909**	**136**	**273**	**127**	**30,328**	**135**
5 Image processing systems	**7,785**	**106**	**1,548**	**100**	**2,510**	**93**	**–**	**–**	**8,748**	**103**
6 Related items & accessories	**14,556**	**108**	**5,969**	**113**	**1,128**	**53**	**–**	**–**	**9,714**	**94**
7 Diagnostic ultrasound	**44,804**	**118**	**30,277**	**123**	**4,212**	**88**	**3,856**	**110**	**18,739**	**103**
8 Therapeutic systems	**4,759**	**104**	**1,113**	**124**	**2,737**	**146**	**337**	**109**	**6,383**	**115**
Total	**205,939**	**112**	**97,332**	**121**	**63,022**	**124**	**–**	**–**	**171,628**	**111**

(Note) Domestic Market: Calculated by the formula (Production – Exports + Imports).

Review of the first half year 2005

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

1. The total count of medical imaging system of the first half of 2005 showed a increase in the domestic market.
   - – Production 205.9 billion yen (+ 22.2 billion yen, 112%)
   - – Export 97.3 billion yen (+ 17.1 billion yen, 121%)
   - – Import 63.0 billion yen (+ 12.2 billion yen, 124%)
   - – Domestic Market 171.6 billion yen (+ 17.3 billion yen, 111%)
2. The domestic market by major equipment showed:
   - – X-ray 56.5 billion yen (+ 2.9 billion yen, 105%)

   The growth of Cardio & angio showed an increase with 11.7 billion yen (123%). On the other hand General-purpose radiography had been decreasing since the year 2003 and decreased to 4.8 billion (65%).
   - – CT 29.7 billion yen (+ 2.4 billion yen, 109%) 701 sets (+ 8 sets, 101%)
   - – Nuclear medicine 11.5 billion yen (+ 3.0 billion yen, 136%) 111 sets (– 23 sets, 83 %)

   PET has shown 8.3 billion yen (+ 3.9 billion yen, 190%).
   - – MRI: 30.3 billion yen (+ 7.8 billion yen, 135%) 273 sets (+ 58 sets, 127%)

   MRI had been either decreasing or leveling out, but it reached to more than 130% over the same period of last year.
   - – Diagnostic ultrasound 18.7 billion yen (+0.6 billion yen, 103%) 3,856 sets (+352 sets, 110%)
3. The production output during the first half of the year 2005 was recorded as 205.9 billion yen (112%).
   - – X-ray 62.8 billion yen (+ 3.2 billion yen, 105%)

   Mobile showed a high growth with the output of 1.9 billion yen (149%), corresponding with the export of 1 billion yen (182%), while General-purpose radiography decreased with 8.4 billion yen (81%).
   - – CT 49.7 billion yen (+ 10.5 billion yen, 127%)

– Nuclear medicine
2.6 billion yen (– 1.0 billion yen, 72%)
– MRI: 19.0 billion yen (+ 1.0 billion yen, 106%)
– Diagnostic ultrasound
44.8 billion yen (+ 6.8 billion yen, 118%)

4. The export on the whole showed a high growth with 97.3 billion yen (121%) as well.
– X-ray 20.3 billion yen (+ 2.9 billion yen, 117%)
– CT 28.5 billion yen (+ 9.0 billion yen, 146%)
– Diagnostic ultrasound
30.3 billion yen (+ 5.7 billion yen, 123%)

But
– MRI: 9.6 billion yen (– 1.2 billion yen, 88%)

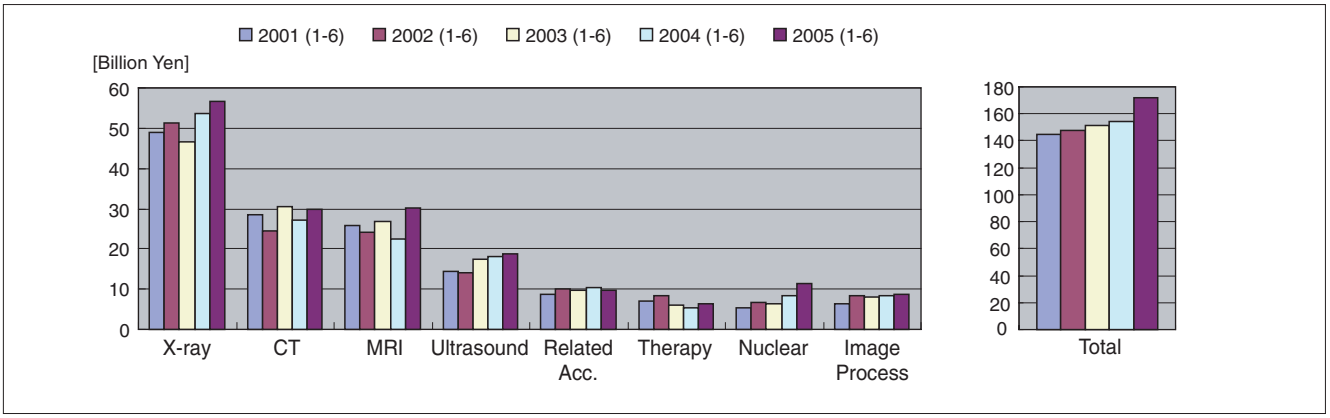
5. The import on the whole, which had been leveling out until the previous period, reached to the performance of 124% and contributed to boost up the domestic market.
– X-ray 14.1 billion yen (+ 2.6 billion yen, 123%)

The import of General-purpose radiography also increased with 1 billion yen (161%).
– CT 8.5 billion yen (+ 0.9 billion yen, 111%)
– Nuclear medicine
9.0 billion yen (+ 4.1 billion yen, 182%)

The import of Nuclear medicine consistently showed a significant growth, which consisted of the growth of PET (6.8 billion yen) centrally.
– MRI: 20.9 billion yen (+ 5.6 billion yen, 136%)
– Diagnostic ultrasound
4.2 billion yen (– 0.6 billion yen, 88%)
– Therapeutic systems
2.7 billion yen (+ 0.8 billion yen, 146%)

Therapeutic accelerator systems increased with the nominal amount of 1.7 billion (241%).

Diagnostic Imaging and Therapeutic Systems Market in Japan
Trends in the Last Five First-Half Years by Modality



Chairman's message for 2006

Masamichi Katsurada, Chairman
Japan Industries Association of Radiological Systems

When we overview the Japanese healthcare system globally, there are demands for sweeping reforms taking a close look at the needs of the society as a whole, and this can be seen as an international trend. From this year, the healthcare service reimbursememnt will be reduced by a record high of 3.16% from the present rate.

On the other hand, there are concerns of whether medical care will continue to function effectively. Even from this point of view, there is a need to review the whole medical system.

In last April, the Pharmaceutical Affairs Law (PAL) was revised radically. One of the principal objectives of the revision is to assure post-marketing safety. For our industries that provide "medical imaging systems" which places most emphasis on "reassurance and safety", this is a very important revision of the law.

"The medical imaging system" is a "cycling type product or system" composing of development, production, sales, distribution, maintenance and repair. The important points of this system are to manage the instrument so that it is kept at the best possible state during long years of use and to maintain the performance that is guaranteed at the time of purchase of the instrument. In this context, thorough maintenance and management of medical instruments is essential to further enhance post-marketing safety assurance

Under such business environments that our industries are facing, I would like to identify the priority activities of JIRA for 2006 based on the same themes that we proposed last year.

The eight items listed below are basically continuation and development of our activities of last year, but I would like to further reinforce the external activities.

1. **Promotion of the visions of medical device industries, and realization of cooperation** (proposal to and cooperation with the administration)
2. **Promotion of measures in response to the revised Pharmaceutical Affairs Law**
3. **Measures for healthcare service reimbursement** (evaluation of technology, manpower, material, maintenance and management cost)
4. **Maintenance of industry and business environment** (maintenance service business, safety measures)
5. **Activation of international activity** (exchange with related organizations overseas)
6. **External proposals, activation of publicity activities**
7. **Compliance, thorough adherence to laws**
8. **Basic service to member companies**

1. Promotion of the visions of medical device industries, and realization of cooperation (proposal to and cooperation with the administration)

In order to continue to develop the medical device industries in Japan, reliable follow-up of the "visions of medical device industries" as well as reinforcing cooperation with and submitting proposals to the related ministries are important.

As you may be aware, such visions have been suggested by our Association, which include the importance of the medical device industries to understand every step in the cycle encompasses development, sales, maintenance, repair and disposal.

If we follow the work performed for these visions, the work of the administration side includes the implementation of the revision of the Pharmaceutical Affairs Law.

We shall continue to cooperate with the administration regarding education and publicity efforts within the industries accompanying the legal revision. However, there remain many issues from the viewpoint of training of medical device industries in the future.

Our Association will continue to propose to the administration about concrete topics such as to promote the installation of "medical device managing units" as described in the "visions of medical device industries", and to establish accreditation system and education system for "medical device managers" (for example, by utilizing persons with formal qualifications such as diagnostic radiographic technologist) for managing statutory inspection systems and medical device as a means to assure quality and safety during use.

As to the demand concerning approvals and reviews in accordance with the Pharmaceutical Affairs Law, this year we shall also propose to establish a review organization by recruiting or utilizing medical engineering manpower or effectively utilizing manpower in the private sector. This will promote the efficiency of approval and review procedures. We shall also consider the cost-benefit performance in the establishment of such organization.

2. Promotion of measures in response to the revised Pharmaceutical Affairs Law

As regards the Pharmaceutical Affairs Law, partly because the implementation is at its early stage and partly because publication of the notifications is delayed, there are confusions in the actual operations. Member companies are probably not clear about how to handle existing products in accordance with the revised law.

Especially, for products that have been upgraded in the classification system, repeat review seems to be required. For companies, this will mean mounting costs for preparing new documents and review expenses.

In addition, for the approval of "market designated controlled medical devices", a system of approval by a third party registration approval body has been introduced. In addition to the extra cost for review, the system is not operating smoothly. In the opinion exchange meeting with the Ministry of Health, Labor and Welfare, this year we shall continue to demand improvement in the time taken and expenses of approval and review by the third party registration approval body.

To further reinforce the post-marketing safety assurance, which is one of the main objectives of the revised Pharmaceutical Affairs Law, thorough maintenance and management of "medical imaging systems" are essential.

Post-marketing safety cannot be materialized solely by the industries that provide "medical imaging systems", and safety can only be assured if the medical devices actually used in the clinical setting are properly maintained and serviced.

At the end of last year, the Medical Service Law enforcement regulations were partially revised. The maintenance of medical devices mainly operated in medical institutions are subject of "specially designated maintenance management required medical devices" provided by the Pharmaceutical Affairs Law. In the future, maintenance will be activated as an extended service operation incorporated as a topic in the "visions of medical device industries" with a view for collaboration with the "Medical Service Law".

3. Measures for healthcare service reimbursement (evaluation of technology, manpower, material, maintenance and management costs)

Regarding "healthcare service reimbursement", we have consistently requested the following four points. These requests will also be continued this year.

(1) Appropriate evaluation of medical technology
(2) Written provision for various expenses on maintenance and management
(3) Appropriate evaluation of medical information provided by application software
(4) Clarification of rationale for calculating healthcare service reimbursement

The biennial revision of healthcare service reimbursement will take place again this year. No only drug cost, but healthcare service reimbursement including doctor's technical fees will be cut by a record high 1.36%. In the future, within the framework of total cut of the healthcare service reimbursement, the allocation of reimbursement for individual medical practices will be decided.

Especially, appropriate evaluation of the significance of "medical imaging system" is important, because it allows accurate diagnosis at the early stage of medical examination. For this purpose also, we shall insist on the main points including appropriate evaluation of medical technology, as well as the reflection of maintenance and check-up for the purpose of maintaining device performance and safety management in the healthcare service reimbursement.

Last year, the "Imaging Diagnosis Consortium" organized jointly by six organizations including medical societies and industries was inaugurated. This consortium was established with the objectives to share information on healthcare service reimbursement between the industry, technologists' association, technology societies and medical associations, and to promote the understanding of "diagnostic imaging systems".

Through the activities of this consortium, we hope to voice our opinions to the administration regarding our demand of an appropriate approach for the healthcare service reimbursement system, in particular in cooperation with the user side of healthcare devices while attempting to match the users' needs.

4. Improvement of industry and business environment (maintenance service business, safety measures)

We shall promote the environment of developing maintenance and check-up as a service industry. In the revised Pharmaceutical Affairs Law, almost all the diagnostic imaging devices belong to the "designated medical devices for maintenance and management". From the sense that proper maintenance is linked to the quality of life of patients, it is essential to implement appropriate maintenance and check-up of devices. It will be beneficial to realize a statutory regular check-up system such as for elevators. We shall submit our request concerning the maintenance operation to the administration.

5. Activation of international activity (exchange with related organizations overseas)

We shall continue to exchange with related industrial associations and organizations in America and Europe such as COCIR and NEMA, and attend the DITTA meeting.

Last year, in Japan the Quality Management System (QMS) Ministerial Ordinance also sought to comply with ISO13485 concerning audit of quality system in factories. Since the third party registration approval body is skilled at audits according to ISO standards such as 13485, etc., we have promoted the procedures for global approval certification. We wrote a position paper as a proposal from Japan recommending a system by

which once the approval certificate of 13485 is obtained, there is no need to undergo other inspections.

In the future, we shall also promote this recommendation to the administration in Japan. This year, JIRA serves as the chair, and we shall plan activities in line with the Global Harmonization Task Force (GHTF) activities.

In addition, we continue to exchange with the administrative bodies, testing organizations and industrial associations of neighboring countries such as China and Korea. Concerning the medical device law in China, we have researched on this law and have heard from the industry that it is effective. Also, we are studying the waste disposal law in Europe. In the future, the activities will be increased with an eye on the trends of various countries.

6. Proposal to external, activation of publicity activities

While strengthening our collaboration with other medically related organizations, we shall continue to make recommendations on reform of the healthcare service system and the healthcare service reimbursement, as well as conduct publicity activities including measures to be taken in responses to the revised Pharmaceutical Affairs Law.

This year, we shall start a new publication "diagnostic Imaging Related Industries 2006" in April, which will feature introduction of our activities; recommendations from our Association concerning industrial policies, healthcare service system and healthcare service reimbursement system; as well as various data.

7. Compliance, thorough adherence to laws

In 2004, we launched the compliance committee and established the "JIRA Compliance Declaration". Last year, we prepared the "Compliance Manual" and "Compliance Card" and used then as tools to educate and publicize compliance in member companies.

This year, we shall conduct publicity activities for these tools and continue to promote compliance in JIRA and JIRA member companies.

In addition, as an activity of Medical Device Fair Trade Council JIRA branch, and as an activity for thorough adherence to medical device fair competition codes, we have continued to conduct publicity activities at the major conferences related to JIRA and also hold training course for "code instructor". We have also played central roles in the activities of the headquarter of the Council, and shall continue these activities this year.

8. Basic service to member companies

For the purpose of information sharing among member companies, we have upgraded the content of the magazine "JIRA Bulletins", and renewed the web site.

In addition, this year we have planned continuing education and other mandatory activities for member companies starting from August 2006 on measures in response to the Pharmaceutical Affairs.

I have explained our main activities of last years as well as the main plans of this year.

The items mentioned above are related in various ways and there is organic connection among them. To obtain the maximum effect from the activities implemented under the priority plans, concerted activities among related academic associations, related industrial organizations and the administration are essential.

I believe that these activities will strengthen the industrial infrastructure and contribute to provide high quality medical care that will result in improving the quality of life of the people.

JIRA Activity Reports

Briefing Report about Medical Device Registration System in China

From September 7 through 14, a mission dispatched by JIRA International Division made a continuous investigation regarding the Chinese regulation through interactions with China Association for Medical Devices Industry (CAMDI), State Food & Drug Administration (SFDA), Certification and Accreditation Administration of the People's Republic of China (CNCA,) and China Quality Certification Center (CQC). In addition, the mission interacted with the Department for Japanese Businesses at International Health Exchange Center, Ministry of Health, P.R China (MOH). The summary is reported as follows.

1. International Health Exchange and Cooperation Center, Ministry of Health, P.R China (MOH)

We participated in the workshop held by Department of Japanese Affairs of International Health Exchange and Cooperation Center, Ministry of Health, P.R China (MOH), which is engaged in promoting the penetration into China by Japanese mid and small-sized companies. See below for the contents.

(1) SFDA medical device registration system in China

a. Governance process law of medical device registration (Enforced on August 9, 2004)

b. Standard recording for application is mandatory: SFDA regulations and quality control system have to be satisfied.

c. Clinical testing and registration testing are required.

d. Submission documents required for product registration application

- Preparation prior to application (Establishing the standard of products → State standard, industry standard, company standard, etc.)
- Clinical testing at two different facilities is required for Class II and III products.
- Documents for submission

1) Application for registration
2) Certificate of qualification as a manufacturer
3) Request letter to a consigner
4) Request letter to a sales representative
5) Acceptance form by a representative
6) Certificate of qualification as a representative
7) Request letter to after-purchase servicing
8) Statement of deposition
9) Examination report (Class II & III)
10) Report based on a company's standard (Class I)
11) Warranty letter of a product

e. Inspections of manufacturers' factories are performed only for Class III.

f. Some of medical equipments use medicine, for which cases SFDA examines.

- Rationale for judgments is based on the one that initiates actions between equipments and drugs.
- For example, the examination is made by pharmaceutical expert as to in vitro diagnostic.

* The department that supervises in vitro diagnostic, etc., will be determined by the end of this year after all inconveniences.

g. Re-registration and application for changes

- Certificates are valid for 4 years, and renewal procedures can be started in 6 months before expiration.
- When type or specifications are changed, application for changes is required.
- Application for changes is also necessary when some changes are made on operation manuals.

h. Software embedded with medical equipments is regarded as part of the medical devices.

- Software for office use such as "Microsoft word" is not regarded as part of medical devices.

i. Importing used products is prohibited, however, they can be used as replacements.
However, tax/food inspection is required, through which problems might be pointed out.

Workshop in MOH

(2) Health insurance system in China

a. The insurance system consists of medical devices and drugs.

b. China is reforming health insurance.

c. Social security system: social aid, insurance, welfare, social preferential treatment for the weak

d. Health insurance system: health insurance, insurance for government officials, etc.

e. Number of insurers of health insurance in China

- 1978: 84 million
- 1985: 122 million

* Health insurance system is established only for government officials and company employees, and therefore, this system cannot cover all citizens.
* Labor insurance system is established only for company employees, and therefore, the overall scale is still small.

f. China started introducing health insurance system for farmers on a trial basis in June of 2005.
- Although this insurance system provides low-level coverage, a number of farmers, who had not have any insurance before, did not hesitate to participate.
- This system has been introduced tentatively at 641 locations (for 225 million people), and 163 million people (72.6%) have actually taken out the insurance system.

g. History of health and sanitation system in China has the following 3 stages.
- 1978 – 1984: Development after Great Cultural Revolution
- 1985 – 1996: Guarantee system by medical services was reformed.
- 1997 – : Healthcare, medicine, health insurance

* A number of problems are observed, and 17% of GDP is spent for sanitation –related matters. The percentage of the sick is as high as 27.4% for those over 60 years old. So, medical system and medical services are being established through separating establishment of hospitals from management of hospitals.

h. China has a policy of preparing legislation and clarifying Healthcare service system at hospitals.
- Medical examination cost will be set moderately, while hospitals will be run based on profits from medicines.
- Government-affiliated public hospitals, private hospitals (profit hospitals, non-profit hospitals)
- The Chinese government is examining the cost classification by 30 symptoms and the fixed payment accordingly.

i. The Chinese government believes that promoting citizens' health is important for further development of healthcare, and it is now examining potential reforms.
- Reasons why healthcare cost has been expensive so far
  1) Too many companies which handle medicine
     → There are not only a number of manufacturers, but also a number of medicine handlers.
  2) Too many distributors (representatives)
     → Drugs are distributed through a number of representatives before they are finally purchased by hospitals.
  3) Bid-corresponding system
  4) Hospitals
- The following actions will be taken in order to directly cut healthcare cost down.
  1) Sales promotion by pharmaceutical manufacturers
     → This will be limited only to real manufacturers.
  2) Distribution management/Shipping Center
     → Distribution will be improved through squeezing middlemen.
  3) Hospitals

Workshop in MOH

2. China Association for Medical Devices Industry (CAMDI)

(1) China does not have any preferential treatment system regarding medical device production.

(2) Tax rate for components of medical devices
- Tax rate for unit assembly: 2% to 6%
- Tax rate for single components: 4% to 15%

(3) The percentage of CAMDI member companies, which have already obtained ISO-13485 among the total of 10,000, is 30% to 40%.

(4) Unfortunately, data of shipped medical equipments is not able to be provided to JIRA. This is because a limited number of companies provide such data and the data is unreliable as well. When reliable statistics is available, it will be provided to JIRA.

Meeting with CAMDI

3. State Food & Drug Administration (SFDA)

(1) Announcements such as new legislation, notice and standard have not been issued since September in 2004, however, some are now in the middle of examination.

(2) Software for medical device: Handling software as single medical device is still performed on a trial basis.
- Software for hardware: It should be applied first together with medical device.
- Software which is used with the approved medical device is regarded as a single medical device.

(3) Clinical laboratories shown on the website are those for drugs. There is no list of clinical laboratories for medical device. Therefore, applicants should choose clinical testing facilities for medical device among hospitals owned by prefectures or larger units.

(4) As a principle, SFDA is supposed to conduct overseas inspections about Class II & Class III medical device. However, it actually does only for Class III medical device.

(5) It sometimes takes more than a month before a certificate is issued after approving procedures are completed. SFDA regards the situation as a matter to be solved internally, and plans to improve the situation.

(6) Currently, X-ray equipments are required to be registered both for SFDA and CCC mark. Unifying these registration systems of medical equipments has been identified as a matter to be handled by State Council. It was confirmed that the request for improvement would require government-level negotiations.

Meeting with SFDA

4. Certification and Accreditation Administration of the People's Republic of China (CNCA)

(1) Unifying SFDA approval and CCC approval for part of products is a matter to be handled by State Council. In order to improve this matter positively, coordination among governments is necessary.

(2) No changes are planned for detailed regulations regarding CCC scheme.

(3) EMC examination for those other than medical device has already been performed. It is possible that EMC examination will be performed for medical device as well in the future.

Meeting with CNCA

5. China Quality Certification Center (CQC)

(1) Unifying SFDA approval and CCC approval for X-ray equipment is a matter to be discussed at State Council, and therefore, it is difficult to achieve a prompt improvement.

(2) No changes are planned for regulations related to CCC approval. No new standard to be applied to related products such as X-ray equipment and ultrasound diagnostic equipment are planned, either.

(3) Applying EMC examination to medical device is now in review.
- With starting EMC measurement sites operation at CQC-related examination centers (3 locations) by April 1, 2007 as a goal, technical training for engineers as well as construction have already been initiated.
- Testing for EMC regulations as to medical device will be performed based on IEC60601-1-2: 2001.

(4) Medical device products will not be regarded as the subjects of the Chinese version of WEEE/RoHS for the time being.

Meeting with CQC

China Business Trip Report

The 2nd Japan-China-Korea Medical Devices Industrial Expansion Conference

In order to hold the 2nd Japan-China-Korea Medical Devices Industrial Expansion Conference, JIRA had been taking initiative and making adjustments with China Association for Medical Devices Industry (CAMDI) and Korea Medical Devices Industrial Cooperative Association (KMDICA). Since it was agreed that the conference would be held in Chengdu on November 1, JIRA International Division visited China from October 30, 2005 through November 2, 2005 for the purpose of attending the conference. We also made a courtesy visit to International Health Exchange Center, Ministry of Health, P.R. China (MOH) and China State Food & Drug Administration (SFDA) and toured China International Medical Equipment Fair held in Chengdu. The information collected during this visit to China is reported as below.

1. Visit to International Health Exchange and Cooperation Center, Ministry of Health, P.R. China (MOH)(Oct. 31, 2005)

The interactions between MOH and JIRA have been very favorable so far. MOH requested JIRA to support the improvement of the relationship with The Japan Federation of Medical Devices Associations (JFMDA), for which JIRA will cooperate with. The exchanged information is as below:

(1) Regarding HOSPEQ 2005 (China International Exhibition for Hospital Equipment organized by MOH)
   a. The number of visitors: approximately 20,000
   b. The number of attendees of welcome reception: approximately 1,000
   c. The number of participants is decreasing. MOH intends to increase participants through the reinforcement of the exhibition.

(2) MOH made a remark about its interaction with JIRA, "We are very impressed by JIRA, which conducts information exchange most frequently among all the Japanese associations. We would like JIRA to keep the attitude."

(3) Department of Japanese businesses at MOH plans to visit Japan in spring of 2006 with the following matters as part of its objective.
   a. Requesting participation by Japanese medical device companies to HOSPEQ 2006
   b. Requesting more attendees from medical device related associations in Japan to future workshops as MOH of China held in 2005

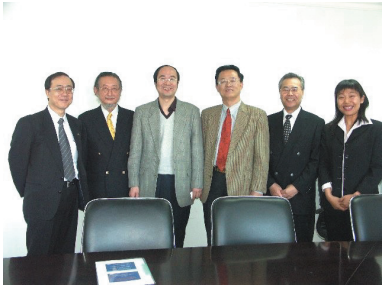
Meeting with MOH

2. Visit to SFDA (Oct. 31, 2005)

The interactions between SFDA and JIRA have been continuously very favorable. JIRA international Division intends to maintain the favorable relationship. Information exchanged between SFDA and JIRA is as below:

(1) Comment by SFDA to JIRA
   a. JIRA must be familiar with medical device related laws in China. We are also very pleased to see that Ministry of Health, Labor and Welfare in Japan has come to show international response.
   b. SFDA will supervise the compliance of medical devices based on Regulation for the Supervision and Administration of Medical Devices.
   c. SFDA, which has been developing regulations so far, is still inexperienced, and therefore, it plans to ask for opinions from overseas governments and associations so that it will be able to further improve the regulations.
   d. SFDA understands that high-level medical devices are produced overseas, and it welcomes the introduction of such high-level products into China.
   e. Introducing used medical devices into China is prohibited.

(2) Comment by JIRA to SFDA
   a. We are very grateful to SFDA's providing a lot of information upon our visit to SFDA in September, 2005. JIRA is now in the middle of organizing the information so that it will be published to its members through JIRA newsletter in the beginning of 2006.
   b. JIRA will participate in the 2nd Japan-China-Korea Medical Devices Industrial Expansion Conference .
      • Exchanging information about medical devices
      • Regarding medical insurance system in Japan
      • Explanation about Pharmaceutical Affairs Law in Japan



Meeting with SFDA

3. The 2nd Japan-China-Korea Medical Devices Industrial Expansion Conference (Nov. 1, 2005)

Through participation to the 2nd Japan-China-Korea Medical Devices Industrial Expansion Conference, we were able to obtain information about medical device markets in China as well as Korea. With the strong request by China, we plan to continue to participate in the conference in the future as long as possible. The meeting summary is as below:

(1) Major information provided by CAMDI

a. The number of member companies: Increased from 10,000 to 14,000.

- Among the members, 8,000 to 9,000 member companies have not yet provided their production data.

b. Turnover of medical devices in China

(USD: Billion)

Year	2000	2001	2002	2003	2004
Turnover	5.56	6.33	7.21	8.25	9.38

* Actual turnover is expected to be much higher due to insufficient data collection.

c. Issues regarding medical devices in China

- Laws related to medical devices have not yet fully developed.
- The medical device market is still premature.
  - There are approximately 40 thousand sales representatives in China, however, their sales turnover has only reached to RMB 2 million. Consolidation of these sales representatives is required.
  - Productivity is still low.
- It is expected that new two kinds of regulations will be established by the end of this year.
  - Regulations regarding distribution of medical devices
  - Regulations regarding biological pharmaceuticals
- Product prices are now too expensive, and therefore, the Chinese government is examining to provide guidance about the prices of medical devices.
  - This guidance will be set up upon a certain mathematical formula by the Customs.
- Response to the future vision by medical devices manufacturers has not been clarified.
  - High technology products are unable to be exported because patent issues have not yet been solved.
  - R&D investment is not enough.
    In Europe, around 12% (compared to GDP) is spent as R&D investment, while only 1% is spent in China.
- In China, healthcare research and development organizations conduct research and development of medical devices. However, good products have not yet been developed when compared to its level of pharmaceuticals.
  - Limited number of people are engaged in research and development of medical devices.

d. CAMDI desires to hold exhibitions clinical researchs with Japan and Korea as its joint partners.

e. CAMDI plans to participate in Global Harmonization Task Force (GHTF) in 2006.

(2) Major information provided by KMDICA

a. The number of medical device manufacturers and importers in Korea

Category	2000	2001	2002	2003	2004
Manufacturers	609	1,025	1,177	1,446	1,668
Importers	995	900	928	950	1,122
Product items	4,828	6,447	7,659	9,300	10,927

b. Medical device market in Korea

(USD: million)

Category	2000	2001	2002	2003	2004	2004 growth rate
Domestic production	690	995	1,073	1,331	1,478	111.0%
Export	415	445	461	515	569	110.4%
Import	730	884	1,028	1,140	1,284	112.6%
Domestic market	1,004	1,432	1,640	1,956	2,193	112.1%

* The growth rate of medical device domestic market in Korea is 12.1% (Compared to 2003.)

c. Imported medical devices to the Korean market

(USD: million)

Category	2002	2003	2004	2004 growth rate
Artificial joint	43	45	49	108.8%
MRI	37	38	48	126.3%
X-Ray	31	41	75	182.9%
Ultrasound	29	31	33	106.4%
Blood Analysis	18	23	18	78.3%
Others	870	962	1,061	110.2%
Total	1,028	1,140	1,284	112.6%

(3) Information provided by JIRA

a. Medical device market information in Japan (Including diagnostic imaging system)

b. The revised Pharmaceutical Affairs Low in Japan started in April of 2005.
c. JIRA's effort to international activities in Europe, America and Asia.

The 2nd Japan-China-Korea Medical Devices Industrial Expansion Conference

4. The 54th China International Medical Equipment Fair

We visited the 54th China International Medical Equipment Fair and realized that the exhibition was the largest scale one for medical device in China. The 1st International Component Manufacturing and Design Show was held together with the above exhibition.

Date: Nov. 1-5, 2005
Place: New International Convention & Exposition Center, Chengdu
Number of Visitors (Estimated): approximately 150,000
Number of Exhibitors: More than 1,000 companies

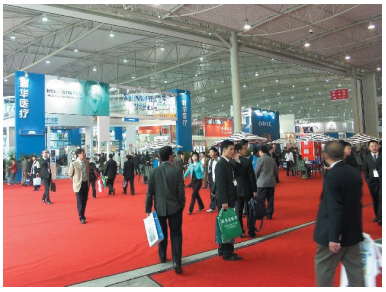
4-1. Impression about exhibitions

(1) Major X-ray equipment and ultrasound diagnostic manufacturers such as Aloka, Shimadzu, GE, Siemens, Toshiba and Hitachi, and film and camera manufacturers such as AGFA, Konica Minolta, Kodak, Canon and Fuji Film exhibited their products in large booths in the center of the exhibition hall, which we found that they were pouring their efforts into China.

(2) Among the exhibited products, new products such as CT, MRI, Cardiovascular systems, CR, FPD and US had a high profile.

(3) The main streets of the city were decorated by exhibition flags and the whole city projected the exhibition. What attracted our attention most was the large number of visitors, which made us recognize that the exhibition was China's largest scale one of medical device.

The spring exhibition is scheduled to be held in Shenzhen, however, the place for the next autumn exhibition has not yet been determined. We plan to focus on the exhibition continuously and to set up a supervised tour.

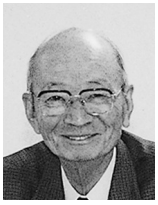


The 54th China International Medical Equipment Fair

Development of Japanese Radiological Equipment in the Post-World War II Period (17)

Beginning of the rise of particle-accelerator therapy equipment

Sumio Makino
Advisor, JIRA



1. Brief outline of the last issue

Cobalt-60, the radioisotope with much higher energy than the conventional X-ray range, took the place of the post-war radiotherapy. Up to the preceding number, the background was reviewed.

Cobalt-60 radiotherapy equipment was rapidly spread, because of improving cure effects, especially decreasing the skin damage, compared with the conventional X-ray therapy, requiring no radiation generator, and relatively facilitating the therapeutic procedure.

It is difficult or impossible to get a perfect score in everything. Even for the Cobalt-60 remote radiotherapy equipment, there was the same situation: from the viewpoint of expecting the perfect radiotherapy that its radiation beam focused on the affected part, the largest problem was the size of the Cobalt-60 source. Even if various ideas were tried to get good focusing, its large size produced a wider penumbra in the irradiation field of the affected part, resulting in bad influence around the affected part, etc.

2. Appearance of particle-accelerator therapy equipment

A. Emergence of betatron therapy equipment

The advantage of the European radiotherapy research is its long-established tradition since the discovery of X-rays by Roentgen in 1895, and lots of Japanese medical scientists studied in Europe, especially in Germany, both before and after the World War II.

In response to the advantage of radiotherapy, researches on the therapy equipment had been performed eagerly by medical treatment doctors and related manufacturers respectively.

As a part of such researches, particle accelerators using Cockcroft-Walton circuit, Van de Graaf and other types of generators were developed for the high-voltage generation methods necessary for producing high-energy radiation (X-rays). It was certain that high-energy accelerators were completed, but their practical applications were not attainable because of a shortage of radiation quantity (power).

As the researches advanced in the second half of 1950s, the Siemens in Germany realized the "Betatron Accelerator" that obtained high energy by means of rotating and accelerating a beam of electrons, and completed the first electron-beam accelerator, that enabled to extract a beam of 18-MeV X-rays, as therapy equipment. The X-ray beam from the betatron possesses much higher energy than the gamma ray (1.33 MeV) from Cobalt-60, as mentioned above. Furthermore, the greatest advantage is that the focus (target) of the X-ray source is small in size, and also the penumbra in question is expected to be small. The promising expectation that

"this would be just the most suitable radiation generator for radiotherapy"

became prevalent, with rapidly increasing the number of medical scientists who had the hope of its domestic use in Japan.

In Japan, two sets of 18-MeV betatron therapy equipment made by German Siemens were installed in 1963: in the National Cancer Center and the Department of Radiology (Chief: Tadayoshi Matsuda) of the Toyohashi Municipal Hospital, respectively (Figure 1). These 18-MeV betatrons were used for the research on intraoperative radiation therapy methodology by Youichiro Umegaki in the National Cancer Center, and for the practical cancer treatment at the upper jaw and other affected parts by Tadayoshi Matsuda. Both cases demonstrated the efficacy of electron beams, which was presented as special reference/guide materials for developing "linear accelerators" (LINAC is the abbreviated designation), as introduced in the next issue.

Since then, higher-energy type betatrons were announced one after another, such as a 22-MeV betatron made by Allis Charmer

in U.S.A. and a 31-MeV betatron made by Brown Boveri (BBC) in Switzerland.

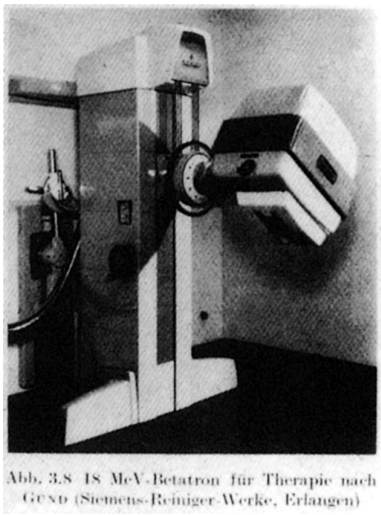


Abb. 3.8 18 MeV-Betatron für Therapie nach Gund (Siemens-Reiniger-Werke, Erlangen)

Figure 1.
18-MeV betatron therapy equipment made by Siemens (1963)

B. Start of developing betatrons in Japan

Around 1958 and 1959, the strong demands for introducing a much higher energy betatron increased rapidly in number from the medical-care field in Japan, on the basis of experiences of high-energy therapy with Cobalt-60.

In 1961, Professor Moriji Fujino of the Osaka City University Medical School got the opportunity to have charge of the 20th general meeting of the Japan Radiological Society (JRS), with his hope for presenting some actual therapy experiences and getting his head start in the "betatron therapy" field in Japan. With the intention of cooperating with his idea, Toshiba Corporation planned to manufacture 15-MeV betatron products, and performed the production task at the Tamagawa Works, which had just moved from the former Fuji Works, on the basis of the fundamental data which had been obtained from the trial production research performed in those days by the radiation research section of Toshiba Central Laboratory. The author (Sumio Makino) was appointed as leader of the production project.

In the west part of Japan, Shimadzu Corporation proceeded actively with the research and development works, in response to the increase of requests from university hospitals, etc. The following is a description of the state of historical development in Shimadzu Corporation, based on the materials issued by Shimadzu Corporation:

Shimadzu Corporation began to develop a betatron as a joint research project with Dr. Tsunesaburo Asada of the Osaka University School of Science in 1953.

First of all, the development work of a 6.7-MeV betatron started, resulting in first outbreak of X-rays with energy as low as about 4.5 MeV in February, 1954, because of a lack of output from its power generator. Since then, its energy was attained up to 6 MeV, and the first 6-MeV betatron for medical use in Japan was completed in 1955, which was practically tested at the Kyoto University Hospital.

On the other hand, another development work of a 15-MeV betatron with small size and high power proceeded with a subsidy from the Ministry of International Trade and Industry to this work. The important research for the betatron to extract its electron beam started in 1958, and after piling up other research data, a 15-MeV betatron for medical use was completed in 1960 and installed at the Kyushu University Hospital, resulting in the start of the first genuine cancer therapy using the betatron in Japan.

For other separate headings:

Higher-energy betatrons were required, as the effective results of electron-beam therapy using the betatron became aware. A 24-MeV betatron was developed in 1965 and delivered to the Osaka Medical Center for Cancer and Cardiovascular Diseases.

In 1967, the Japanese government attached greater importance to cancer therapy measures, and determined to install the newest betatron as the most up-to-date and powerful therapy equipment. Shimadzu Corporation completed 32-MeV betatrons for therapy use (Figure 2), which possessed the highest energy in Japan, and delivered to both the Kyoto University Hospital and the Kyusyu University Hospital.

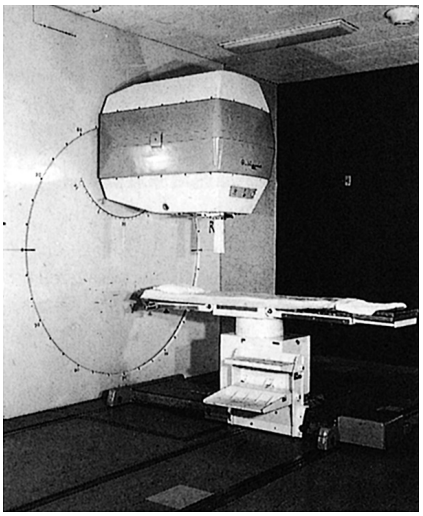


Figure 2.
32-MeV betatron therapy equipment (Shimadzu Corporation) (1967)

On the other hand, in 1966, Shimadzu Corporation had developed the first betatron for exclusive use of electron beams in the world, which had notable features to improve the weak points with electron beam therapy, SUCH as the poor dose distribution, and the low power output from low energy.

In 1967, 20-MeV small-sized electron-beam therapy equipment was also completed in response to prevalence of high-energy electron beam therapy.

--- The rest is omitted. ---

C. The author's experience in the project of producing a 15-MeV betatron

For us, the Toshiba project team, who had little experience except producing X-ray equipment, our challenge to the particle accelerator --- betatron --- looked just like diving into a quite new world.

Our first work was to study "what is a betatron?"

It was hard work to cultivate all members of the project team including myself. Just as returning to first-year pupils, we studied hard and took field trips: such as investigating the principle of electron acceleration, the role of each structural component and electron accelerating tube (doughnut tube), especially the methodology of finally colliding the electron beam against the "target", and others.

When the time came just to enter the manufacturing work stage, first of all, we became aware of the great difference between our manufacturing process in the past and the process to manufacture, test and manage a large magnet. The magnet belongs to the field of what was called the heavy electric machine: in Toshiba, for example, the magnet is the product at the "Tsurumi Works" of the special factory in such a field. So, we had frequent visits to the mammoth factory, where we were able to make contact with seniors and engineers in the field of heavy electric machines, who traveled all over the world to do business for such machines. As a result, it seemed understandable that there were great differences in various thoughts, policies, stratagems, and others between such an engineering group and us, the "workers for medical equipment" who had awareness of much smaller issues. Figure 3 shows the magnet assembly for the 15-MeV betatron.

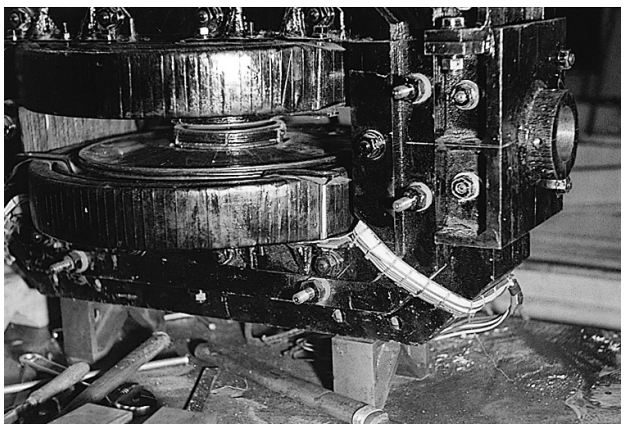


Figure 3. 15-MeV betatron magnet assembly

In our factory for medical equipment, it was very hard to only lift up the magnet; but in this heavy machine factory, it was easy to lift up and carry the magnet indoors just like a small bean. Here were the scale difference and other points at issue for our betatron production. This became a good lesson for investment in plant and equipment toward our new industry.

On the other hand, an electron tube, what was called the "doughnut tube", was designed by the late Hirosi Kamogawa, the chief research engineer in the Toshiba Central Laboratory, and also manufactured at the Electron Tube Works. (Figure 4)

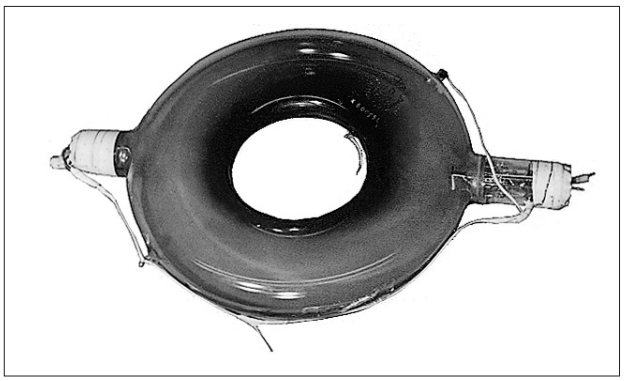


Figure 4. Doughnut tube for the 15-MeV betatron

The magnet has a gap in which the doughnut tube is occupied. Inside the doughnut tube installed in the gap, an electron beam generated from an electron gun is accelerated, finally colliding against a small target, and generating X-rays. The mutually related location between the doughnut tube and the magnet is the greatest problem on the manufacturing process: the location affects sensitively the rotating motion of the electron beam, but it is hidden inside the magnet and invisible. The optimum performance of rotating the electron beam in the magnetic field is attainable only by quite blindly moving the doughnut tube little by little. This work depends on intuition or the sixth sense without any technical measures, and results in taking a long time at the exchange of the doughnut tube in the hospital --- the doughnut tube is one of expendable supplies --- in order to obtain a stable electron beam. This problem as the betatron therapy equipment remained insoluble to the very end.

By making arrangements somehow or other, we completed the "15-MeV rotating type betatron therapy equipment", and delivered to the Osaka City University in 1960. We felt quite relieved when we arranged this first particle accelerator --- betatron, but we needed to always send "specialists" with "intuition or the sixth sense", every time the doughnut tube was exchanged.

Figure 5 shows just the betatron therapy equipment.

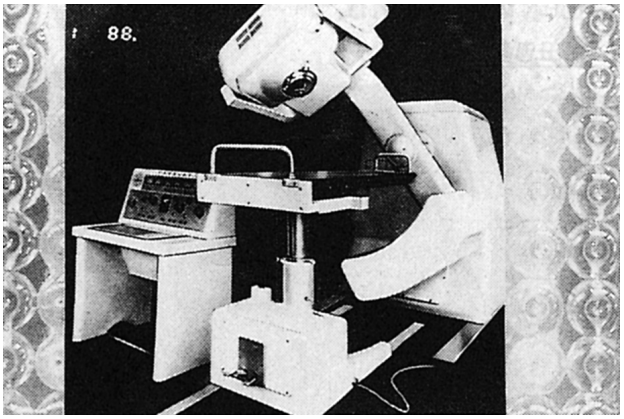


Figure 5. The first betatron therapy equipment in Japan (15 MeV) (in Osaka City University, 1960)

D. Emergence of various types of betatron therapy equipment

(1) 31-MeV betatron therapy equipment

As stated above, much higher energy betatrons, such as 18 MeV, 31 MeV, and others, had been already manufactured in Europe, and demands of a high-energy betatron and wishes of its use were raised from radiotherapy doctors in Japan. Among them, a plan of installing 31-MeV betatron therapy equipment was embodied in the National Institute of Radiological Sciences (General Director: Kenpo Tsukamoto) of the Science and Technology Agency. It was investigated in fiscal 1963 whether the betatron should be imported from abroad (BBC) or domestically produced including bids. Through the help of favorable circumstances that the National Institute should consider the promotion of domestic technology, it was decided to domestically manufacture the 31-MeV betatron and undertake to complete it by Toshiba Corporation. Again, the author took the charge of the project, and Kamogawa of the Toshiba Central Laboratory mentioned above undertook the responsibility of technological leader.

As a matter of course, the principle is same regardless of energy, but the whole size of the 31-MeV betatron was much larger than the 15-MeV equipment, just like the ratio of a large adult to a child in the kindergarten.

First of all, the conferences on the structure were piled up with the persons in charge of the National Institute of Radiological Sciences, including Director Tsukamoto. Finally, the structure was determined to be rotating therapy equipment hanging from the ceiling, in spite of its large size, and the Institute came to construct a new building.

Kenjiro Hashimoto of our group took charge of the system design, with referring to data from abroad. The result became large-scaled, using the upstairs room of the building for the rotating system.

As stated above, it is theoretically weak to technologically search the methodology to manufacture the betatron, and so it took a much longer time, contrary to our expectations, for contriving to complete the 31-MeV betatron.

Figure 6 shows the 31-MeV betatron therapy equipment completed. It was just a big project which required about 3 years until its completion.

Since then, another 31-MeV equipment was installed at the Aichi Cancer Center. Furthermore, it is No. 1 topic that the same equipment was exported to U.S.A. and installed at the Miami City University Hospital in Florida (the late Dr. Fix), where the high-energy electron-beam therapy was actively performed.

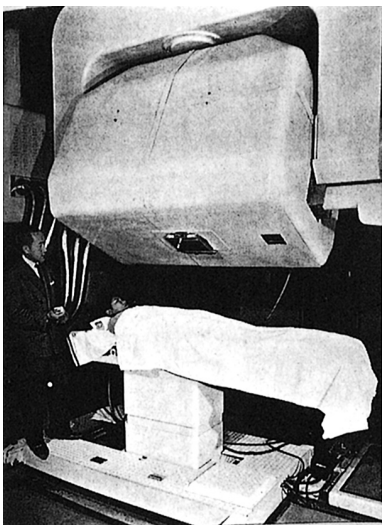


Figure 6. 31-MeV betatron in National Institute of Radiological Sciences Standing person: Kamogawa, Chief Research Engineer

(2) Various types of betatrons

As experiences of the 15-MeV electron beam therapy were piled up, a little higher energy electron beams were desired, resulting in manufacturing betatrons higher than 20 MeV and increasing the energy types of betatrons. The result is shown as follows:

Siemens AG	15, 43 MeV
Shimadzu Corporation	6, 15, 20, 24, 25, 26, 32 MeV
Toshiba Corporation	15, 18, 21, 31 MeV

(Yoshio Onai: "Progress of Radiological Equipment", in a special issue of the Toshiba Medical Review)

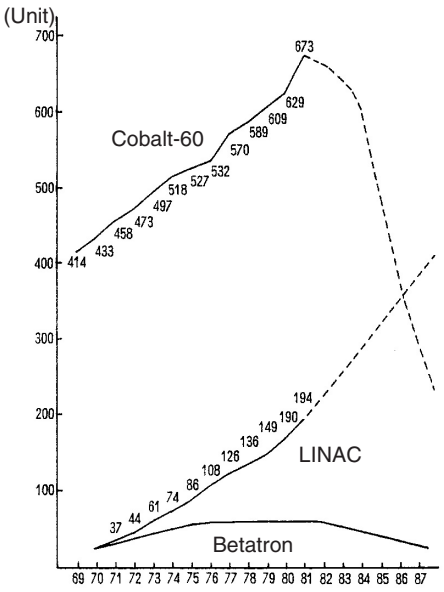
E. Problems concerning the betatron as therapy equipment

To make better use of the high-energy radiological therapy obtained from RI therapy equipment such as Co-60 and Cs-137, the betatron was developed as the particle acceleration system with much higher energy. Certainly, this was to comply

with such an expectation. It was the great progress that the electron beam therapy demonstrated its great ability to the shallow affected part such as the upper jaw and the lower jaw, and also that contiguous irradiation became possible for the intraoperative irradiation methodology in the National Cancer Center. Because of the low output of X-rays, however, the meaningful effect was not necessarily demonstrated to the deep affected part such as the abdomen.

For such problem, as well as the week point that the maintenance was not so easy, as stated above, the spread of the betatron was too difficult to receive the market succeeding to the position of Cobalt-60.

The following graph shows such a result:



[Graph] Rise and fall of radiological therapy equipment (number of installation in each year)

3. Summary of this article

It is the truth that radiological therapy entered into the era of particle acceleration, and the era started first from such an electron accelerator as betatron. The betatron had the weak point that its small X-ray dose is not satisfactory, just as God does not give two gifts to us.

In those days, a 6-MeV linear accelerator was announced by the Varian Medical Systems, Inc. as the similar particle accelerator. In comparison with the betatron, the linear accelerator had much more X-rays and electron beams, and so the interest of therapy doctors shifted rapidly to the linear accelerator even in Japan.

The origin of the linear accelerator (LINAC) in Japan will be described in the next issue.