



Healthcare Technology Management (HTM) by Japanese clinical engineers ~ The importance of CEs in hospitals in Japan ~

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Japanese Clinical Engineers(CEs)



Approximately 70 institutes

- From designated technical college to university
- 3 or 4 years study
- Syllabus from engineering to various clinical discipline
- Mandatory to clinical practice at the hospital while studying institutes



National
Examination



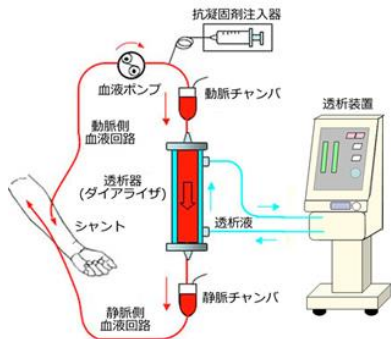
Japanese Clinical
Engineers

2,000 CEs/year

National
Licence

- CEs ACT was established in 1987 under MOHLW
- Paramedical Profession, Medical Technologists
- To perform life-support equipment under the direction of physicians
- We are called “Clinical Engineers”
- 40,000 people work

Safety Management in hospitals



Present

● 1980s ~
1990s

- Daily operation of medical devices were performance by physicians and nurses
- Faulty devices were repaired by the manufacture of the distributer

- Perform life-support medical device under the direction of physicians by Japanese Clinical engineers(CEs)
- Maintain most of medical devices by Japanese Clinical engineers(CEs)



Yamagata University Hospital



Yamagata Prefecture



Department of Clinical engineering, Yamagata University Hospital



- Started the services in 2011
- Sixteen staffs
- The main activities: Extracorporeal circulation, Blood purification, Hyperbaric oxygenation, HTM and training.
- Working at operation room, dialysis room, cardiac catheterization room, ICU, HCU, NICU, emergency room and wards.
- Maintaining approximately 2,100 medical devices



Operating
Extracorporeal
circulation
machine



Maintaining an
anesthesia
machine

Table 1: Mechanical ventilator condition



year	2004	2005	2006	2007	2008	2009	2010	TOTAL
Inspection times	275	290	250	339	388	430	466	2430
Cases of suspected mechanical ventilators failure	11	9	13	28	28	28	34	151
▪ Ventilator volume	0	0	5	21	18	20	26	90
▪ Oxygen concentration	5	5	3	5	9	6	7	39
▪ Malfunctions	6	4	5	2	1	2	2	22
Number of mechanical ventilators	15	18	21	24	28	30	30	-
Minor problems	62	60	49	47	25	10	12	265
Failures	17	11	5	3	0	4	0	40

● Cases of suspected mechanical ventilator failure: These failures were discovered by using the PTS-2000 calibrator at the time of after-use inspections.

● Minor problems and failures: The incidents of mechanical ventilator failure that occurred while in use in general wards or the ICU.



Table 2: Details of mechanical ventilator failures

	Faulty Parts	Result of accuracy test	Repair			
			Successful Calibrated	Parts exchanged		
Ventilator volume	Flow Sensor	Decrease in tidal volume	24	12	12	☆
		Increase in tidal volume	4	2	2	☆
		Calibration error / breakdown	62	-	62	☆
			90	14	76	
Oxygen concentration	Oxygen Sensor	Decrease in oxygen concentration	6	3	3	☆
		Increase in oxygen concentration	32	6	27	☆
			39	9	30	
Malfunctions	Circuit Board	ventilation defects	10	-	10	★
	Flow Trigger Sensor	Auto triggering	1	-	1	★
	Pressure Trigger Board	Auto triggering	1	-	1	★
	Battery and Filter	Weak Battery / Deteriorated Filter	10	-	10	☆
			22	-	22	

☆ In-house: Parts could be replaced in-house by CEs.

★ Distributor: When in-house repair by CEs was impossible due to a serious problem, the ventilator was sent to the distributor for repair.

Development of the Intermittent pneumatic compression device (IPCD) tester



Obtaining inspection results with high reliability by IPCD Tester



Objects: 99 intermittent pneumatic compression devices that is maintained by clinical engineers at our hospital.

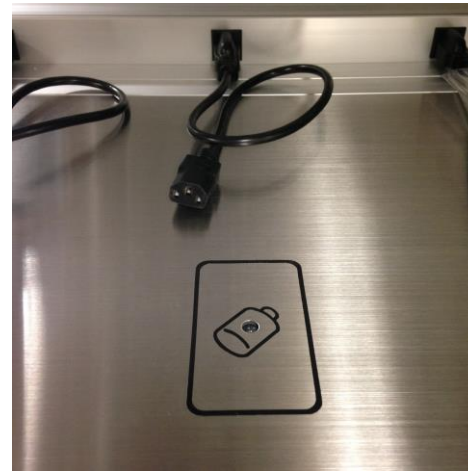
	Air pressure		System errors	
PASS	94		95	
FAIL	5		4	
Location	In-house	Manufacture	Manufacture	
	2	3	2	2
Cause of damage	Air leak from air flow passage	Compressor malfunction	Pressure transducer malfunction, Compressor malfunction	Unknown
Repair	Reconnected the air tube inside of SCD	Compressor Modulation 2, Replacement1	Pressure transducer Calibration 1 Compressor Modulation 1	Non

	Leak			
PASS	150			
FAIL	48			
Location	In-house			
Damaged parts	Connector		Tube	
	18		30	
Cause of damage	Break	Crack	Crack	pinhole
	3	15	8	22



Development of the VOLT BANK

Construction of a safe operating system and efficient battery-charge management for battery-equipped medical equipment.



OK Mark
(White, blinking)



COMPLETION Lamp
(Green, Lighting)

CHARGING Lamp
(Orange, Lighting)

The benefit of established clinical engineering department in the hospital



Some of healthcare technology management (HTM) initiatives include

Rental equipment

- Oversee use and conduct in-house testing and repair, avoiding faulty units.

Ventilator maintenance

- A multi-year track record of assessing and replacing defective parts in-house, contributing to prompt repairs and reduced costs.

Intermittent pneumatic compression device dedicated tester

- Reducing the incidence of thromboses and embolism in patients

Battery-equipped devices

- Created a more efficient system for charge management.

Conclusions of Japanese CEs



The combined user and maintenance role of CEs is unique in Japan.

HTM initiatives include;

- Decreasing medical equipment user errors.
- Safer care delivery and cost-effective equipment management.

→ Clinical Engineers in Japan has had a significant impact on improving patient safety.



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**Thank you
for listening**

