Efforts Towards Enhancing the Quality of Radiological Services in Malaysia: Review of Patient Dose Surveys 1993-2007

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Abstract

The Ministry of Health (MoH) Malaysia is continuously taking steps to improve the quality of radiological services provided by the public and private medical institutions. This is to ensure that optimum diagnostic information is obtained with the least exposure to patients as well as staff. Over the years, MOH has taken both administrative and legislative measures to enforce the various requirements under the Atomic Energy Licensing Act 1984. In order to further upgrade and enhance the quality, safety and efficacy of radiological services, implementation of the Quality Assurance Programme (QAP) has been made mandatory. Implementation of the QAP comprises certification of irradiating equipment, training of personnel (continuous professional education), film reject rate analysis and film auditing and assessment. All these particulars must be documented and submitted annually to the MoH in order to comply with licensing requirements.

It is envisaged that with the implementation of QAP, the medical institutions will be able to institutionalise and internalise the culture of quality and safety in the applications of radiation in medicine. This implementation will indirectly result in reduction of dose to the patient and importantly in optimization the use of ionizing radiation in medicine. With the QAP in place a survey of doses to patient in 7 routine x-ray examinations was initiated in 1993 to provide a reference dose baseline in Malaysia. This was then followed by further dose surveys involving other modalities namely interventional radiology, mammography, adult chest and abdominal x-rays and computer tomography dose index (CTDI) for head and body phantom in CT scanner. The results of these dose surveys will be reviewed in this paper.

The results of the mean entrance surface dose (ESD) (mGy) to patients in 7 routine x-ray examination done (1993 – 1995), the mean values of dose area product (DAP) ($Gycm^2$) for patient undergoing interventional radiology (cardiac and non cardiac procedures) (2000-2001), the mean glandular dose (MGD) (mGy) in mammography (2000-2001), the mean entrance surface dose (ESD) (mGy) for chest and abdomen (2001-2002) and CTDI survey in CT Scanner (2007) were found to be generally well within the normal range of international standards. However, there will still be opportunities for further improvements in terms of patient dose reduction without affecting image quality. With this in view, a National Dose Survey encompassing the whole range of procedures in diagnostic radiology was initiated in 2007 and is expected to be completed in mid 2009. The results gained from this survey will be used to assist in introducing dose reference guidance levels in Malaysia.

***KEYWORDS**: Radiation dosage; Interventional Radiology; Entrance Surface Dose; Dose area product meter; Mean glandular dose; Computed Tomography Dose Index*

Appendix 1

Table 1: Results of Survey of doses to patients in 7 routine x-ray examinations (1993-1995)

Examination Projection		Patient Weight (kg) [mean, range]	kVp [mean, range]	mAs [mean, range]	ESD (mGy) [mean, median, range]
Chest	PA	59;(45-81)	79;(55-125)	9;(2-30)	0.28, 0.26;(0.05-0.74)
	LAT	58;(45-81)	88;(65-120)	19;(4-122)	1.40, 1.17;(0.27-3.80)
Abdomen		60;(45-75)	71;(60-85)	57;(13-100)	10.00, 9.22;(1.67-24.45)
Pelvis hip		61;(45-82)	70;(60-90)	40;(9-80)	8.41, 5.33;(1.14-30.91)
Skul	AP/PA	58;(45-80)	71;(56-87)	38;(5-70)	4.78, 4.74;(0.72-8.27)
	LAT	59;(45-80)	68;(56-81)	32;(7-70)	3.34, 3.03;(0.42-7.66)
Cervical Spine	AP	58;(45-79)	66;(50-80)	16;(6-40)	1.02, 0.70;(0.37-3.07)
	LAT	59;(45-79)	69;(60-85)	20;(5-40)	1.60, 1.49;(0.23-3.96)
Thoracic Spine	AP	58;(45-82)	72;(60-82)	48;(13-80)	7.03, 6.39;(2.21-12.87)
	LAT	59;(44-82)	81;(63-92)	62;(11-12)	16.54, 15.92;(2.66-39.24)
Lumbar spine	AP	60;(45-75)	77;(60-96)	51;(10-100)	10.56, 9.06;(2.24-30.68)
	LAT	61;(45-75)	89;(60-125)	72;(11-160)	18.60, 13.97;(4.96-56.92

Table 2: Results of Survey on patients undergoing interventional radiology (2000-2001)

Procedure	No of Patients	Total fluoro time (min) [mean, range]	No of images	DAP ($Gycm^2$) [mean, range]	ESAK (mGy)
CA	176	5.4,(0.7 - 81.8)	618	48.6,(6.3 - 452.8)	-
PTCA-SI	32	26.6,(1.8 - 87.5)	1008	147.2,(22.4 - 477.0)	-
CA-PTCA-SI	70	21.5,(1.9 - 81.4)	1180	153.0,(18.8 - 655.0)	-
Nephrostomy	12	8.3,(3.1 - 19.3)	22	31.5,(12.6 - 70.6)	100.4
Lower limb angiography	7	23.4,(7.2 - 61.5)	272	109.4,(4.1 - 209.2)	64.9
Chemoembolization	6	29.7,(19.6 - 45.9)	49	127.7,(30.9 - 237.9)	107.0
Abdominal angigraphy	4	17.2,(4.3 - 53.2)	105	88.5,(49.3 - 125.5)	135.3

CA – Coronary angiography, PTCA- percutaneous transluminal coronary angioplasty, SI – stents implantation

Table 3: Results of the study on MGD in mammography (2001-2002)

Study	View	No of mammo Unit	kV [mean, range]	mAs [mean, range]	MGD per film (mGy) [mean, median, (1^{st}Q, 3^{rd}Q)]	MGD per woman (mGy) [mean, median; (1^{st}Q, 3^{rd}Q)]
2001 - 2002	CC	30	26;(25 - 31)	117,(7 - 21)	1.54,1.44;(1.04 - 1.86)	3.37,3.21;(2.50,4.01)
	MLO	30	26.5;(25 - 31)	160;(15 - 819)	1.82,1.65;(1.26 - 2.21)	

CC- Craniocaudial; MLO- Mediolateral

Table 4: Results of the chest and abdomen survey (2001-2002)

Examination Projection	No of Centre	kVp [mean, median, range]	mAs [mean, range]	ESD (mGy) [mean, median, range]
Chest	63	86.4, 80.0; (60 - 125)	7.8;(1.2 - 25.6)	0.24, 0.19;(0.06 - 0.76)
Abdomen	35	68.9,70.0;(60.0 - 80.0)	50.3;(18.7 - 96.0)	3.17,3.07;(1.29 - 7.48)

Table 5: Results of the CTDI survey for head and body phantom (2007)

Examination Projection	No of CT Unit	kVp [mean, range]	mAs [mean, range]	$CTDI_w$ (mGy) [mean, range]
Head	40	121.4; (120 - 130)	197; (80 - 450)	20.45; (1.30 - 52.20)
Body	40	121.4; (120 - 130)	173.4; (80 - 330)	8.98; (0.56 - 22.62)