CHAPTER 4

RESULT

The results on quality control of CR system and x-ray machine were within acceptable range of AAPM protocol (Appendix A).

Figure 22. Quality control of x-ray machine

4.1 Perspex phantom study for dose and image quality determination

Table 3 shows the DAP dose, calculated ESD and image quality by varying the perspex phantom thickness and kVp. The phantom image quality was evaluated by the high contrast resolution and the low contrast detail resolution from Leeds phantom, TOR 18 FAGIL. At each phantom thickness, choose the optimal exposure parameter to set the exposure factor chart as shown in table 4.

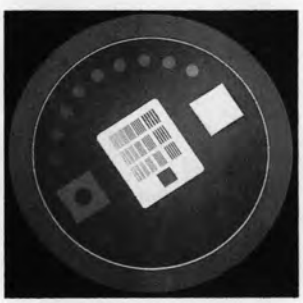

Figure 23. Leeds phantom, TOR 18 FAGIL

Table 3. Summary data of the exposure technique, the average dose from DAP meter and calculation and image quality of the perspex phantom.

PMMA Thickness (equivalent chest thickness) cm.	kVp	mAs	DAP Reading cGy.cm^2	ESD mGy	S-value	Image quality: High contrast resolution Groups of line pair	Image quality: Low contrast resolution No. of circles
	90	0.8	2	0.022	895	14	14.5
5	120	0.6	2	0.028	492	14	14
(11-14)	130	0.6	2	0.033	391	15	13.5
	140	0.6	3	0.038	340	15	13.5
	150	0.6	3	0.042	325	15	13.5
	90	1.2	2	0.034	1077	15	13
7	120	0.6	3	0.03	649	15	13.5
(15-18)	130	0.6	3	0.035	540	15	13.5
	140	0.6	3	0.04	470	15	14
	150	0.6	3	0.044	391	15	12.5
	90	1.2	2	0.036	1077	16	12
8	120	0.9	3	0.047	745	15	13
(19-22)	130	0.6	3	0.036	634	15	12
	140	0.6	3	0.041	492	15	12.5
	150	0.6	3	0.046	481	15	12
	90	1.6	3	0.051	1127	15	12.5
10	120	0.9	3	0.05	817	15	12
(23-26)	130	0.9	4	0.058	728	15	11
	140	0.9	4	0.066	695	15	11.5
	150	0.6	4	0.049	592	15	12
	90	2.8	6	0.094	1452	15	12
12	120	1.2	5	0.07	1077	15	12
(27-30)	130	1.2	5	0.081	875	14	11
	140	0.9	4	0.069	798	14	11.5
	150	0.9	5	0.077	711	14	10

Table 4. Optimal kVp for the application to various patient chest thickness on the AEC Mode.

Chest thickness (cm)	kVp	mA
11-14	90	400
15-18	120	320
19-22	130	320
23-26	150	320
27-30	140	320

4.2 Patient dose and image quality scores.

4.2.1 Patient dose

In this study, 160 patients for chest radiography were collected. At thickness 15-18 cm the average ESD was 0.058 mGy (0.045-0.112) the mAs was 0.9 (0.9). At thickness 19-22 cm the average ESD was 0.072 mGy (0.054-0.075) the mAs was 1.05 (0.9-1.2). At thickness 23-26 cm the average ESD was 0.079 mGy (0.065-0.098) the mAs was 0.98 (0.8-1.2). At thickness 27-30 cm the average ESD was 0.084 mGy (0.068-0.092) the mAs was 1.1 (0.9-1.2) as details in Table 5. At chest thickness 11-14 cm, the data could not be collected as the patients were in exclusive criteria.

Table 5. Relationship between chest thickness (cm), BMI (kg/m^2) and mAs

Chest thickness (cm)	kVp	BMI (kg/m^2)			mAs		
		Min	Max	Avg.	Min	Max	Avg.
15-18	120	16.23	24.44	19.34	0.9	0.9	0.9
19-22	130	18.37	27.73	22.37	0.9	1.2	1.05
23-26	150	23.74	48.24	30.14	0.8	1.2	0.98
27-30	140	28.41	31.14	29.97	0.9	1.2	1.1

Table 6. Relationship between chest thickness (cm) and ESD (mGy)

Chest thickness (cm)	kVp	ESD (mGy)		
		Min	Max	Avg.
15-18	120	0.0453	0.1121	0.0579
19-22	130	0.0539	0.0751	0.0721
23-26	150	0.0646	0.0981	0.0794
27-30	140	0.0684	0.924	0.084

Table 7. Summary patient information and average entrance surface dose (mGy)

	Min	Max	Average
Patient entrance skin dose (mGy)	0.045	0.12	0.068
Chest thickness (cm)	15.5	29	21.66
Weight (kg)	40	110	60.62
Height (cm)	145	177	158
BMI (kg/m^2)	16.8	48.24	23.96
S- Value	552	1028	707

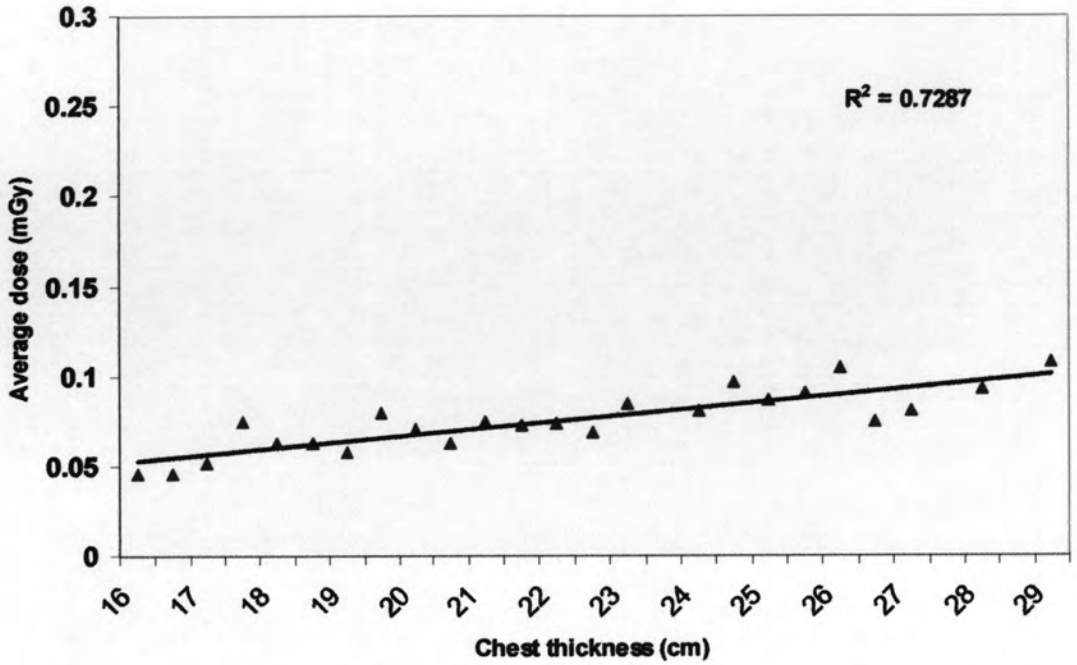

Figure 24. Relation between Chest thickness (cm) and average skin dose (mGy)

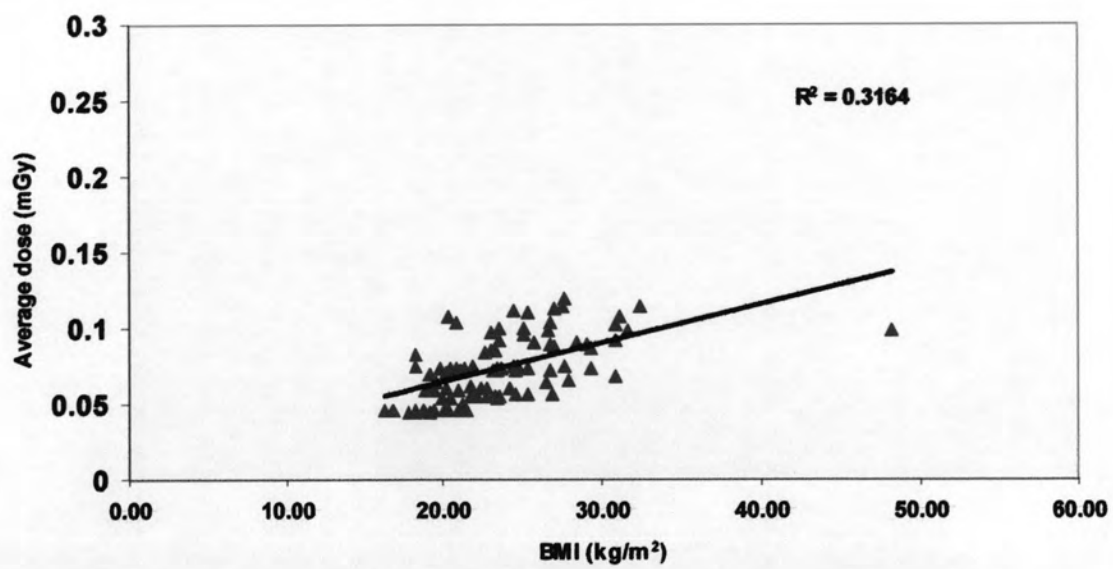

Figure 25. Relation between BMI (kg/m^2) and average skin dose (mGy)

4.2.2 Patient image quality scores.

For the image quality scoring as shown in table 8, the average and range score of image quality for chest thickness of 15-18 cm the average score was 7.22 (6.5-8.0), chest thickness of 19-22 cm the average score was 7.08 (5.5-7.5), chest thickness of 23-26 cm the average score was 6.5 (6-7.5) and chest thickness of 27-30 cm the average score was 6.6 (6.5-7) from the maximum of 8. The overall average score was 6.93.

Table 8. Data of score of image quality in patients of different chest thickness.

Chest thickness (cm)	Score of image quality		
	Min	Max	Average
15-18	6.5	8	7.22
19-22	5.5	7.5	7.08
23-26	6	7.5	6.5
27-30	6.5	7	6.6
Average score of image quality in patients			**6.93**

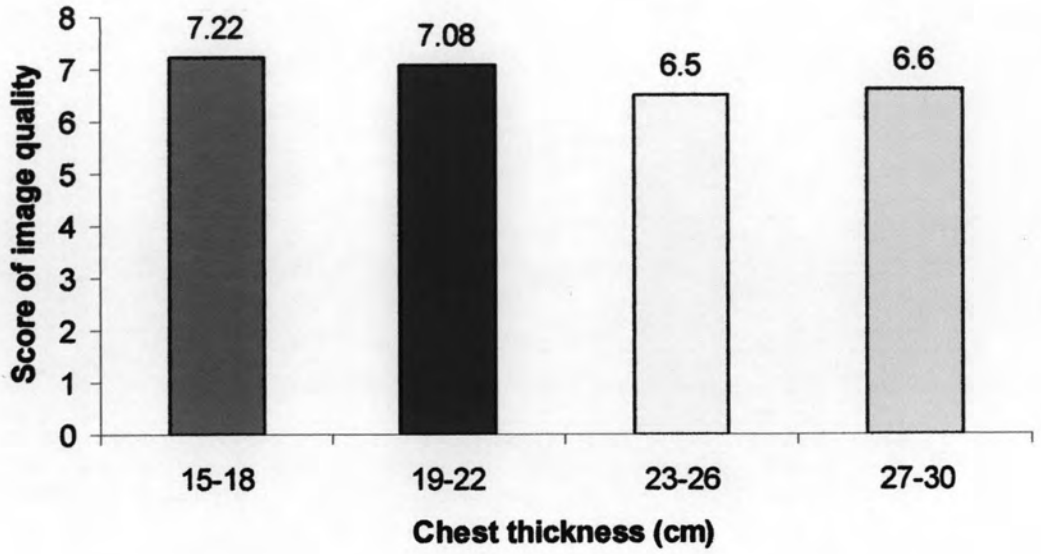

Figure 26. Image quality score of patient at various by chest thickness

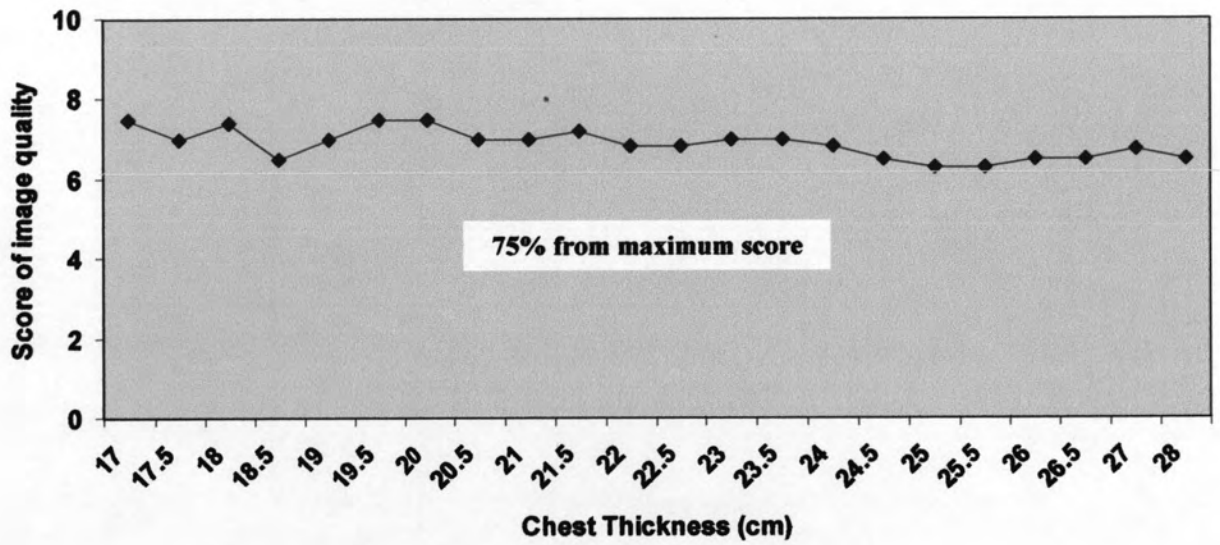

Figure 27. Relationship between chest thickness and score of image quality.

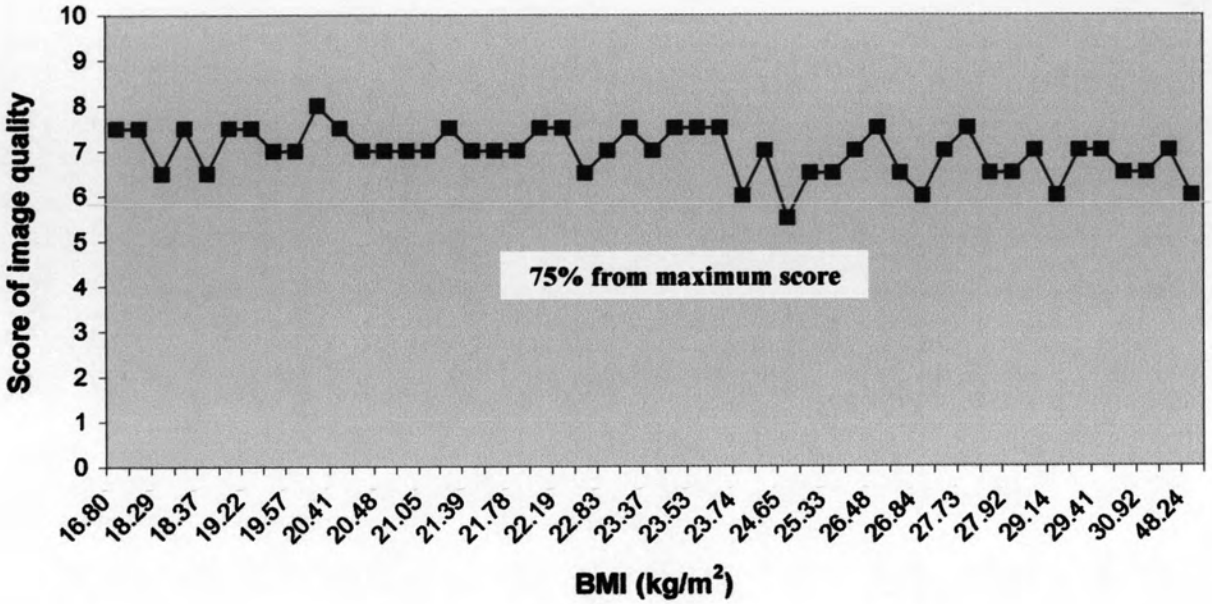

Figure 28. Relationship between BMI and Score of image quality.