Archival Quality of Radiographs in a University Teaching Hospital

[1]Adejoh Thomas** and [1]Obatu S.N. Mitchelle*

*BSc Radiography
**BSc Radiography, MSc (Medical Imaging)

[1]*Radiology Department, Nnamdi Azikiwe University Teaching Hospital, Nnewi, Nigeria*
Correspondence: Adejoh, T.: adtoms@yahoo.com ;
+234(0)8133301005

ABSTRACT

Objective: To assess the degree of deterioration of archived radiographs.

Methodology: Every stored X-Ray wallet in the department was retrieved and the radiographs assessed for any change in appearance using a viewing box. The faults identified were tabulated. Simple statistical tools were used to calculate central tendencies.

Result: One thousand and forty three radiographs were archived from 2002 to 2011 with 540 (51.8%) showing evidence of deterioration and 503 (48.2%) normal in appearance. Faults identified include discoloration, water marks, fading, moulds and cardboard paper dust.

Conclusion: A high degree of deterioration of archived radiographs was noted in the centre. A change in strategy in the method of film archiving is advised in order to preserve the diagnostic value of radiographs for medico-legal and research purposes.

Keywords: radiograph, archive, faults

INTRODUCTION

Diagnostic radiology requires accurate interpretation of complex signals in medical images [1]. The credibility of a radiologist in the eyes of the public will be severely compromised if pertinent medical images such as radiographs under their direct or indirect control are lost [2]. A review of literature revealed that about one third of American hospitals had serious problems, particularly lack of space [3] which seriously hampered storage and retrieval of radiographs. Space constraint notwithstanding, courts view with disfavor any spoliation of radiographs that may eventually become evidence [3].

Although picture archiving and communication system (PACS) are being designed to replace traditional film archiving system [4] it has been noted that courts are not current with PACS and tele-radiography and that in litigation, guilt will almost assuredly be inferred if radiographs that are to be safeguarded are lost [2]. Loss of radiographs is quite possible since one of the major problems in the management of a modern department of Radiology is undoubtedly the organization of a radiologic archive [3]. To address this challenge Radiology Information Systems (RIS) was established to manage information in the department [7] and laws to govern the retention of radiographs has been made by countries like the US [2]. In our environment, neither the laws nor a reliable RIS are in place.

Although a review of literature indicates that medico-legal reason stands out as the *raison d'être* for archiving radiographs in the developed world, it appears however, that in our centre research, much more than medico-legal reasons, is the remote motivation for storage. In our facility which is a University Teaching Hospital there is no specific, designated archive for radiographs. Nevertheless, radiographs were found in different locations of the department which came in handy for this work. This work sought out to find out if there was deterioration in the quality of the images in our archived radiographs.

MATERIALS AND METHODS

From departmental records a minimum of 11,000 radiographs were processed in 2011 giving a 9-year estimated figure of 99,000 from 2002-2011. However, only 1075 (1%) were archived in the department within that period. Within a two-week period in 2012 radiographs were retrieved from the darkroom, corridors, shelves mounted on corridors and from the sorting room. Every X-Ray wallet emanating from and kept in the Radiology Department were retrieved by the researchers and inspected with the aid of a viewing box. 32 radiographs produced from other facilities as well as those without dates were excluded. 1043 radiographs (97%) were eventually accepted and categorized into years of production. They were further sub-divided into normal and deteriorated depending on whether or not there were changes in their appearance. Simple statistical tools were used to measure central tendencies.

RESULTS

Table 1 shows the distribution of archived radiographs per year, with number or normal and deteriorated films. in the year 2010 529, (50.7%) radiographs were stored while 2002 and 2003 had 1 (0.1%) each. In all 540 (51.8%) of stored radiographs deteriorated while 503 (48.2%) were normal. Table 2 gives the sizes of stored radiographs. Four sizes were identified. The least size of radiograph was 18 x 24cm which recorded just 16 (1.5%) while the 43 x 35cm, 35 x 35cm and 30 x 24cm were used at an almost equal proportion of 387 (37.1%), 326 (31.3%) and 314 (30.1%), respectively.

Shown in table 3 are some faults accounting for the deterioration. Faults identified included discoloration: 361 (66.8%), discoloration and water marks: 68 (12.6%) , image fade: 54 (10%) , cardboard paper dust: 42 (7.8%), mould: 10 (1.9%) and water marks: 5 (0.9%). In Table 4 distribution of the radiographs according to year of production and the faults developed are outlined.

Table 1: Distribution of Archived Radiographs according to Year of Production

Year / Variable	2011 (%)	2010 (%)	2009 (%)	2008 (%)	2007 (%)	2006 (%)	2005 (%)	2004 (%)	2003 (%)	2002 (%)	Total (%)
Total	142	529	258	24	58	19	0	11	1	1	1043
Deteriorated	27 (19)	262 (49.5)	151 (58.5)	18 (75)	53 (91)	19 (100)	0	8 (73)	1(100%)	1(100%)	540 (51.8)
Normal	115 (81)	267 (50.5)	107 (41.5)	6 (25)	5 (9)	0	0	3(27)	0	0	503 (48.2)

Table 2: Sizes of archived radiographs included in the study

Size (inch)	Normal (%)	Deteriorated (%)	Total
17x14	182 **(47%)**	205 **(53%)**	387
14x14	168 **(51.5%)**	158 **(48.5%)**	326
12x10	144 **(46%)**	170 **(54%)**	314
10x8	9 **(56%)**	7 **(44%)**	16
Total	503 **(48.2%)**	540 **(51.8%)**	**1043**

Table 3: Faults seen on archived radiographs

S/No	Description of radiographic fault	Frequency	Percentage
1.	Discoloration (brownish/yellow)	361	66.8%
2.	Discoloration + water marks (mixed)	68	12.6%
3.	Fading of image	54	10.0%
4.	Cardboard paper dust	42	7.8%
5.	Mould (fungus)	10	1.9%
6.	Water marks	5	0.9%
	Total	**540**	**100.0%**

Table 4: Deteriorated Radiographs with respect to Year of Production

0	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	Total
Discoloration	4	184	106	6	47	10		4			**361**
Discoloration + water marks (mixed)	2	26	12	8	5	9		6			**68**
Fading of image	10	37	4	2						1	**54**
Water marks	1		3	1							**5**
Mould (fungus)	2	5				2			1		**10**
Cardboard paper dust	10	12	17	2	1						**42**
Total	29 **(5.4%)**	264 **(49%)**	142**(26.3%)**	19 **(3.5%)**	53 **(9.8%)**	21 **(3.8%)**	**0**	10 **(1.8%)**	1**(0.2%)**	1**(0.2%)**	**540**

DISCUSSION

Our findings show that 1075 radiographs were archived in the radiology department. More than half of this, 540 (51.8%) were found to show evidence of deterioration with discoloration and water marks (80.3%) being the most frequent (table 3).

Despite the documented medico-legal advantage derived from well-stored radiographs, the researchers came to the conclusion that radiographs were dumped, rather than archived in the centre in focus. Our assertion derives from the fact that X-Ray wallets were retrieved from humid, hot and dusty places not conducive for sustaining archival quality. A study has reported that space constraint was a major problem in the establishment of radiology archive in one-third of American hospitals [3] but they in no way suggested that radiographs should be dumped carelessly about the department as a result of that.

Vecchioli et al [5] were also of the opinion that the organization and management of a radiology archive was difficult .This was however disproved by King et al [6] who found great effectiveness in radiology archiving operations. Arenson et al [4] and Nanni [7] on their own part recommended PACS to take care of the challenges. Although our centre may share in the constraints espoused by previous workers, the researchers are of the opinion that if they tried hard enough they could overcome the challenges of space.

There were also no records to show how and when radiographs were archived. Retrieval of radiographs for research or medico-legal analyses would therefore be a herculean task, if ever it was contemplated. Evidently, patients went away with their radiographs as shown by the small number (1075 ; 1%) archived in a nine-year period (table 1). There were also no records or plan in place to trace the radiographs if need be. The findings of the researchers is shared by Berlin [2] who strongly recommends that a system should be in place to trace radiographs sent out of the department.

Discoloration of radiographs which appeared to be the dominant cause of deterioration was noted in practice to be the concomitant of hypo retention as a result of inadequate washing during the processing stage .

Water marks on the other hand may have arisen from stuck radiographs due to pressure, heat and high humidity. In retrieving radiographs for our work the researchers found them stacked on themselves which increased the pressure on those below and probably trapped water droplets. Best practices in the storage of radiographs and films involves stacking them separately with no one exerting any pressure on the one below.

CONCLUSION: Deteriorated radiographs are not useful for research as well as medico-legal cases. The huge rate of deterioration of radiographs noted in this centre (51.8%) is worrisome. Centres with space constraint may consider the current trend in film archiving which is Picture Archiving and Communication System as well as Radiology Information System.

REFERENCES

1. Akgül CB, Rubin DL, Napel S, Beaulieu CF, Greenspan H, Acar B. Content-based image retrieval in radiology: current status and future directions. J Digit Imaging, 2011;24(2):208-22.

2. Berlin Leonard. Malpractice Issue in Radiology: Storage and Release of Radiographs. AJR 1997;168:895-897

3. Vosburgh, KG. Storage and Retrieval of Radiographic Images. Radiology, 1977;123:619-624

4. Arenson RL, Sesshadri SB, Kundel HL, DeSimone D, F Van der Voorde, Gefter WB et al. Clinical Evaluation of a Medical Image Management System for Chest Images. AJR 1988;150:55-59

5. Vecchioli SA, Capocasa G, Vincenzoni M, Campioni P, Marano P. Management of radiologic archive in a diagnostic imaging department. Rays, 1998;23(2):330-40.

6. King JL, Miller DW, Sweitzer MC, Rayborn V, Hoffart M & Gur D. File management in a radiology department. American Journal of Roentgenology 1999; 172(5): 1185-1188

7. Nanni M, Carnassale R, Napoli M, Campioni P, Marano P. Information systems in the management of the radiology department. Rays.2003;28(1):63-72.