

CT & MRI Data Backup Recording Integrity on CD – DVD

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Abstract: Medical digital imaging is nearly totally replacing conventional. Large volumes of scans and images are generated daily, which are transmitted and archived by PACS. PACS and servers are costly, especially in developing countries. Computer discs are an old method of saving and transmitting data but are still used. They also partially or near totally replace films by transmitting different scan copies to patients. This study aims to assess the durability of saving digital imaging data of CT and MRI on it for long durations of years.

Objective: to assess CT and MRI Data Backup recording integrity on CD – DVD

Materials and Methods: Retrospective study investigating the data integrity of 382 cases of CT and MRI different scan types were saved on 62 CD and DVDs within the duration of June 2007 to November 2018.

Results: The total data volume was 49433 Mb of total scans number 99437 scan images (17 CT cases of total scans number 6937 images and 365 cases of MRI of total scans number 92500 scans). Only 0.6 % of the data was lost with good preservation of all other data of different scans.

Conclusion: CDs and DVDs are a good method of data saving for several years when preserved in a proper manner. It can also serve as an alternative method of data backup of scans for different purposes.

Keywords: Data Pack up, PACS, CD, DVD, Digital Imaging.

1 Introduction

Digital imaging has been the main form of data in radiology in the last decades. Day by day, the replacement of conventional imaging methods by digital imaging tools is occurring all over the world, either in governmental or in private hospitals and clinics. The picture archiving and communication system "PACS" depends mainly on digital imaging systems and the DICOM form of medical images; without it, it would not be applicable. Digital images of different scans and modalities are saved on the servers of PACS. Digital Video Disc or Digital Versatile Disc (DVD) is an optical storage technology having a large-capacity CD, invented in the middle of the 1990s with advanced multimedia support with at least seven times the storage capacity of a CD-ROM and manufactured for about the same storage price, which makes it lower in storage cost, with faster access time. Pack-up and data transmission are dependent on internet connections, but the use of CDs or DVDs is still widespread. The integrity of this data saving is an important point that should be investigated (1-5).

2 Material and Methods:

This retrospective study was done in December 2023 in the radiology department of the faculty of medicine at Sohag University, Egypt. Investigating and analyzing digital scans of 382 cases of CT and MRI were recorded on 62

CDs and DVDs for different purposes within the duration from June 2007 to November 2018. The purposes of packing up these cases on CDs and DVDs were as follows:

- Saving of important findings and case operative data,
- Saving cases for teaching.
- Transmission of data for consultation before the establishment of PACS—on 15 November 2015—or during intermittent durations of non-working, either due to breakdown or internet interruptions.

Different types of DICOM viewers were used to open each CD and DVD to check and record data saved on it (Onise, Sante, Paxera, Phillipse, Radiante & Radiante&Millensys mini viewer), as explained in table 1.

Table 1: Different types of DICOM viewers used in the study

Hitachi MRI system DICOM Viewer	Paxera DICOM Viewer
Philips DICOM Viewer R2.5.	Orpalis DICOM Viewer
Mi Viewer from Millensys	Radiant DICOM Viewer
Sante DICOM Viewer	Onis DICOM Viewer

3 Results:

The total data volume was 49433 MB of total scans, numbering 99437 scan images (17 CT cases of total scans numbering 6937 images and 365 cases of MRI of total

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scans numbering 92500 scans). 31 CDs were used versus 31 DVDs. The capacities of the CDs and DVDs used were two main types: CD-R 600 MB and DVD 4.7 GB. 12 (11 CDs and one DVD), representing "19%", are saving CT scans, while the other parts of 50 CDs/DVDs are saving data from MRI scans (20 CDs and 30 DVDs).

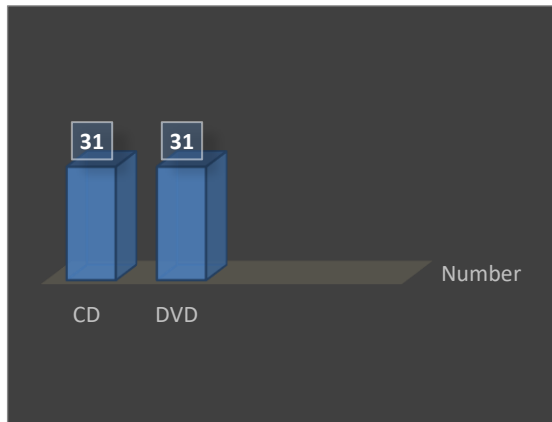


Fig. 1: Number of CD versus DVD used in the study.

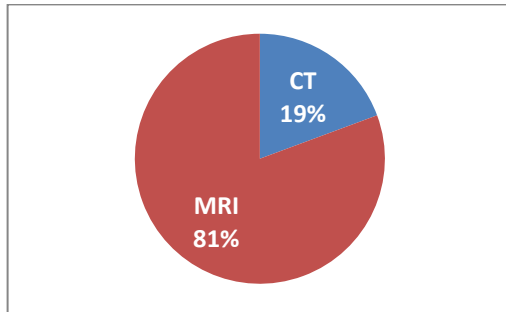


Fig. 2: Percentage of data of each modality saved on CD / DVDs of the study.

The total number of each per year is explained in table 2. The oldest CD was dated June 2007, and the oldest DVD was dated April 2011, while the newest one of them was dated November 2018. Only during 2009 were no CDs included in the study.

Table 2: Number of each CD or DVD included in the study per year.

Year	CR	DVD	Total	Percent
2007	1	0	1	0.016
2008	1	0	1	0.016
2009	0	0	0	0
2010	4	0	4	0.064
2011	0	1	1	0.016
2012	1	0	1	0.016
2013	2	14	16	0.258
2014	4	4	8	0.129
2015	2	0	2	0.032
2016	6	1	7	0.112
2017	9	8	17	0.274
2018	1	3	4	0.064
TOTAL	31	31	62	100%

Only 4 DVDs (i.e., 0.64%)—2 are dated 2013 and 2 are dated 2017—were diffused and non-working due to gross mechanical improper use causing visible scratches on their surfaces, which means this is not due to their older duration, as the older ones still work. More than PCs or laptops were used to try to open it to confirm their disintegration and that the non-opening is not related to malfunction of the used DVD reader. Some case study or case report articles were published depending on some data saved in this study (Figs. 3 & 4).

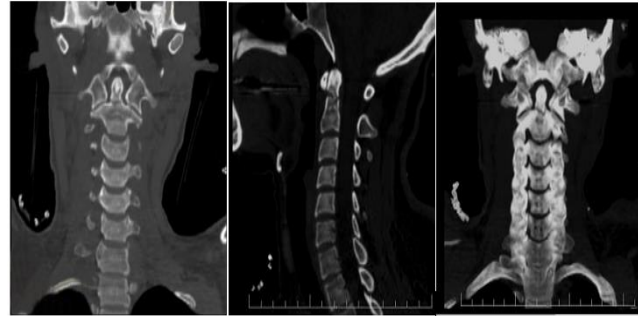


Fig. 3: A, B&C Female patient 26 y, exposed to MCA at Feb 2016 and presented with odontoid fracture type II, follow up was done for non-surgical Minerva external Fixation which is succeed even with pregnancy of the case. Published as case report (Abodahab 2023)(5).

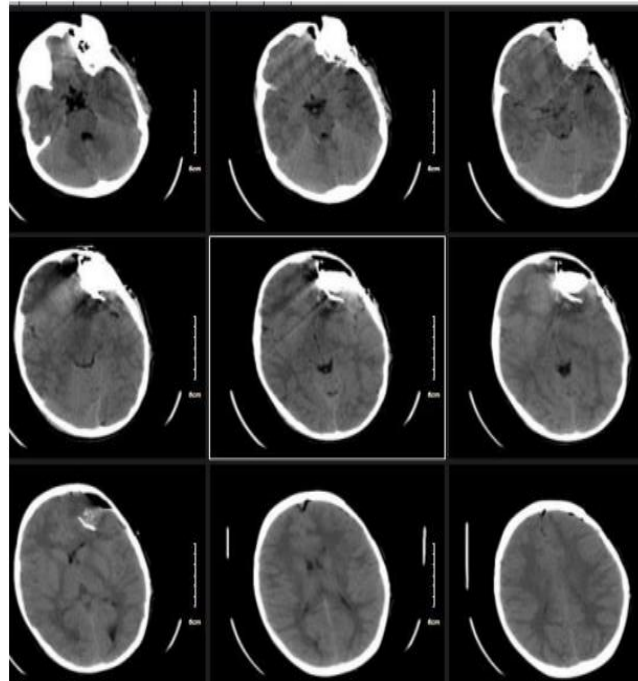


Fig. 4 Data of the case on CD dated June 2007, A 5-year-old male patient; Axial non enhancing CT scan of the head brain window, different scans at and above the level of the penetrating stone. That causing minimal related artifact less than caused by a metallic object of the same size. Published as a case report at 2023 (Abodahab & Abdelbary 2023) (6).



Fig. 5: A&B Data from the case of a 70-year-old female who presented with pelvic and arm trauma are saved on a CD dated Oct 2016 for operative purposes, while PACS services are not extended to the operative theater. The data is fully preserved with the capability of image reformatting, as explained. The case has not been included in any research before.

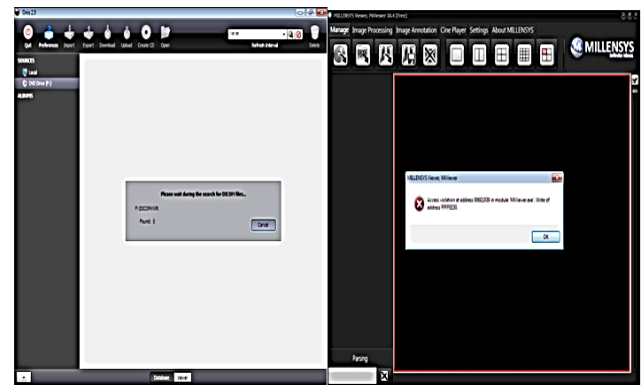


Fig. 6: Lost data on non-working CDs was underwent more than one trail of opening by multiple DICOM viewers on multiple PCs or laptops.

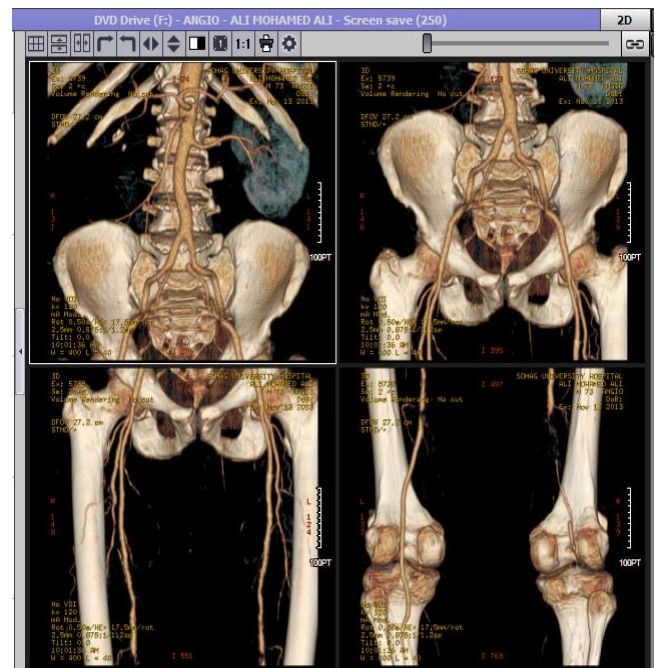


Fig. 7: a case of CT angiography showing focal stenotic segments at different levels. The case data saved on a CD dated Nov 2013.



Fig. 8: A&B A- All used CD & DVD in the study which kept in Specific plastic boxes B- Non working CD of the study it showing unclear surface with coarse scratches.

4 Discussion:

4.1 Advantages:

CD or DVD backup and saving of data, of course, never can and cannot replace the functions of PACS, but in developing countries suffering from main infrastructure problems that interfere with the regular functions of PACS, it may have the following advantages and partial solutions.

- **Electricity:** Electricity interruption is a real problem facing hospitals in developing countries. Without UPS, the integrity of any electronic machine is in danger, including PACS servers. Packing up certain important data on CDs or DVDs is completely avoidable.
- **Internet:** The interruption of the internet now is either related to electricity interruption or malfunctions by the supplier even in the presence of electricity.
- **Weather:** The extremes of weather throughout the year without 24-hour established air conditioning in the summer with temperatures up to 40°C in the shade, or a warming system in winter with temperatures down to 4°C or even less at night is a loading factor, especially high temperatures, which can interrupt the integrity of the PACS server if the suitable temperature wasn't adjusted all the time.
- **Data transmission:** for the purposes of
 1. Consultation
 2. Operative data exploration
 3. Teaching
 4. Judicial purposes
- **Coast:** still saving data on CD and DVD as a cheap, non-limited, slowly expandable method of saving data, with the horrible daily increase in costs of hardware that becomes more difficult to acquire, still CD or DVD is a temporary solution to saving data for previous purposes when expanding of loaded PACS servers is inaccessible or evacuating of spaces is required without loss of old data. Easy mechanical sorting is still an advantage of using a CD or DVD when good, brief data is well written outside it.

Our study is in total agreement with (VAN OOIJEN ET AL.2010) that minor scratches on a CD do not cause damage to data, and our study concluded that saving data on a CD or DVD is safe from 10 to 17 years but only when well saved without bad use.

Our study still agrees (Robert D. Cox et al., 1997) that CDs and DVDs are a low-cost, good method of archiving even after 27 years of this study, which are safer than USB flash memories, which are easily attacked by viruses and make data on them vulnerable (7-15).

5 Conclusion:

PACS is the main or even only key to medical imaging data archiving and transmission, but many factors may interrupt its integrity, especially in developing countries where the extension of PACS to every part of the hospital may be costly, or even if extended, it may be interrupted by non-regular essentials such as electricity or internet services. CD/DVD data backup and transmission is a suitable solution that has proven to be safe for up to 10 to 15 years, but only when well saved with no vigorous use that causes significant scratching of its surface. This method is a cheap, expandable method for data backup and physical transmission.

Abbreviations:

CD	Compact Disc
DVD	Digital Video Disc or Digital Versatile Disc
DICOM	Digital Imaging Communication
Mb	Mega Bite
Gb	Giga Bite
MCA	Motor Car Accident
PACS	Picture Archiving & Communication System
PC	Personal Computer
UPS	Uncorrupted Power Supply

References:

- [1] Abodahab A.M. (2021) Auto Routing and Auto Delete Two Options Absence Can Stop PACS Work: a Review J. Eco. Heal. Env. 8, No. 3, 27-28
- [2] Abodahab A.M. , Tharwat M., Alserafi A., & Fawzy K. (2020) Implementations of PACS and Teleradiology Systems: An Updated Review of the Literature" Journal of Ecology of Health & Environment J. Eco. Heal. Env.8, No. 2, 21- 25 <http://dx.doi.org/10.18576/jehe/080203>
- [3] Robert D. Cox, Christopher J. Henri, and Patrice M. Bret (1997) CD-Based Image Archival and Management on a Hybrid Radiology Intranet. Journal of Digital Imaging, Vo110, No 3, Suppl 1 (August), pp 168-170
- [4] E. R. REDDY and N. VARATHA RAJAN (1998) DVD : The Storage Media CALIBER·98. 4·5 March. Bhubaneswar, pp.69-73
- [5] Abodahab A.M. (2023) Radiological assessment and follow-up of a nonsurgically treated odontoid process fracture after a motor vehicle accident in Egypt: a case report. Journal of Trauma and Injury. www.jtraumainj.org J Trauma & Inj. Volume 36(4); pp: 1-5.
- [6] Abodahab A.M. and Abdelbary E.A. M. (2023). Skull Penetrating Stone due to falling from height: A Case

- Report. SVU-International Journal of Medical Sciences. Vol.6, Issue 1, pp: 397- 405.
- [7] P. M. A. van Ooijen, A. R. Viddeleer, F. Meijer , and M. Oudkerk (2010) Accessibility of Data Backup on CD-R after 8 to 11 years. Journal of Digital Imaging, Vol 23, No 1 (February 2010): pp 95Y99
- [8] Richard E. H. & Andrew L R (2014) Evaluation of Self-Contained PACS Viewers on CD-ROM J Digit Imaging 27:470–473 DOI 10.1007/s10278-014-9675-2
- [9] Supriya Gupta, Elizabeth M. Johnson & Justin G. Peacock, et al. " Radiology, Mobile Devices, and Internet of Things (IoT)" Journal of Digital Imaging <https://doi.org/10.1007/s10278-019-00311-2> - Jan 2020.
- [10] Branstetter BF, IV, MD : Basics of Imaging Informatics, Part 1 RSNA (2007) Radiology: Volume 243: Number 3—June (2007).
- [11] Rade Babić, Zoran Milošević, Gordana Stanković Babić, "Teleradiology - Radiology at Distance" Professional article Scientific. Journal of the Faculty of Medicine in Niš 2012;29(3):145-151 DOI: 10.2478/v10283-012-0020-8
- [12] Indres Moodley & Sivani Moodley A comparative cost analysis of picture archiving and communications systems (PACS) versus conventional radiology in the private sector. 2015;19(1)
- [13] Brent J. Liu and H.K. Huang "Picture archiving and communication systems and electronic medical records for the healthcare enterprise" Biomedical Information Technology - Jan 2020 Elsevier Inc. ISBN 978-0-12-816034-3, <https://doi.org/10.1016/B978-0-12-816034-3.00004-3> - Page 105.
- [14] Chernyshov, A.V.. (2023). Some results of the integrity control of optical discs with recording based on the results of four years of storage in the archive. University proceedings. Volga region. Technical sciences. 10.21685/2072-3059-2023-2-1.
- [15] Bradley K. Risks Associated With the Use of Recordable CDs and DVDs as Reliable Storage Media in Archival Collections: Strategies and Alternatives. UNESCO. Paris, 2006:31.