ORIGINAL ARTICLE

Radiation Protection Practices of Staff during Extra-Corporeal Shock Wave Lithotripsy at Okada, Nigeria

[*]**Eze K C**, *MBBS, FMCR, FWACS* **Nzotta C C**, *MSc, PhD*, ***Eze C U**, *BSc, MSc*, ****Omordia N**, *BSc, MPH*, *****Salami T A T**, *MBBS, FMCP* ****Okegbunam B**, *BSc.*

Department of Radiology, Irrua Specialist Teaching Hospital, Irrua, Edo State, Nigeria. ** Department of Physics, Ahmadu Bello University, Zaria, * Department of Radiology, University of Benin Teaching Hospital, Benin-City, ***** Department of Medicine, College of Medicine, Ambrose Alli University. Ekpoma, ****Department of Radiology, Irrua Specialist Teaching Hospital, Irrua, Edo State, Nigeria.*

Abstract

Background: *The study was designed to find out the radiation protection practices of radiologists and other staff involved in the first extra-corporeal shock wave lithotripsy in Nigeria, performed at Igbinedion Hospital and Medical Research Centre, Okada.*

Methodology: *Some members of staff who were present when the extra-corporeal shock wave lithotripsy (ESWL) was used in the hospital at Okada were interviewed between November 2002 and August 2003. Radiology records of the hospital were studied. Literature search involved available publication on the procedure in local and international journals with interest in precautions to reducing radiation exposure.*

Results: *Only lead apron and lead gloves were used by the radiologists for radiation protection and shielding during fluoroscopy procedures. The fluoroscopy was the screen type with TV monitor. Multiple sessions were used in several patients with multiple pre- and post- treatment radiographic studies including contrast studies with average of two sessions per patient. All the patients were adults aged between 26 and 65 years with mean age of 42.5 years. 627-6000 shock waves were delivered over 45-135 minutes at intensity of 143-19KV depending on patients build and the size of the stones. The sizes of the patients varied from very obese with large bulk to slim built. Radiation monitoring of the staff and patients was not done. Staff believed that radiation effect from the lithotripsy procedure was low therefore adequate radiation monitoring and radiation reducing alteration in the procedure was rarely adopted.*

Conclusion: *Extended fluoroscopy time, multiple fluoroscopy examinations, multiple treatment sessions and multiple x-ray examinations which increased both the patients' and staff's radiation exposures were noted. Proper radiation protection and monitoring of patients and staff are necessary to avoid the risks from low-level exposure to radiation such as in ESWL.*

Key Words: Extra-corporeal, Shockwave, Lithotripsy, Radiation, Protection, Practices, Doctors

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Introduction

Extra-corporeal shock wave lithotripsy (ESWL) was first performed in Nigeria at Igbinedion Hospital and Medical Research Centre, Okada in 1992. It functioned for 6 years. During this period, over 32 patients were treated[1]. ESWL involves the use of shock waves in the form of electromagnetic waves [2] or piezoelectric waves [3]. The procedure also involves the use of ionizing radiation through the use of fluoroscopy, plain films and intravenous urography for confirmation and localization of the stones before and after each session of the treatment. Multiple x-ray examinations are inevitable both before and after the lithotripsy treatment [1,4, 5]. Occasionally, radionuclide studies are used to assess the patients. Therefore doctors using the lithotripsy machine for treatment and other fluoroscopy guided procedures must bear in mind the radiation exposure of both the staff and patients and ensure that these are kept to the minimum [4-6.]

Since its introductions, little attention has been paid to the radiation effect of the procedure as it was not initially considered a radiological procedure. However, recent evidences are emerging on the serious exposure of doctors, patients and other personnel to the radiation effect of the procedure [7, 8.] The time spent by both the radiologist and the urologist during the procedure in the event of a large stone, multiple stone or staghorn calculi is long making the fluoroscopic exposure to be high and requiring radiations monitoring to reduce both the patient and personnel exposure [1,4,5,8.]

Correspondence to ***Dr K. C Eze***

This study was undertaken to explore the actions actually taken to prevent or minimize radiation from getting to the staff as well as the sensitivity and proactive nature of Nigerian radiologists and other doctors involved in the first ever performed extra-corporeal shock wave lithotripsy in Nigeria. Available evidence of their attitude and practices towards avoiding any extra and unnecessary radiation to the patients and staff were examined. Their perceived adjustments to avoid any short or long term adverse effect of the different treatment options and modalities through alteration in the procedure, were also investigated.

Materials and Method

The study was conducted from November 2002 to August 2003. 2 radiologists, 3 other doctors, 2 radiographers and 2 darkroom technicians who were involved in carrying out the at extra-corporeal shock wave lithotripsy (ESWL) in Okada were interviewed. The records at the radiology department of the hospital as well as the patients' records were studied. Literature search was conducted on published papers concerning the first ESWL performed in Nigeria. Relevant information was extracted from the records and the interviews of the staff.

Result

There were full records on 32 patients and they underwent a total of 51 ESWL treatment sessions with multiple sessions recorded in some patients. Among the patients' records and hospital records studied, there was no radiation monitoring of patients or staff. Only lead apron and lead gloves were used by the radiologist towards radiation protection and shielding during fluoroscopy procedure. The fluoroscopy was the screen type with TV monitor, without dark adaptation. Multiple sessions were used in several patients with multiple pre- and post- treatment radiographic studies including contrast studies. All the patients were adults with adequate co-operation reducing fluoroscopy time. Between 627-6000 shock waves were delivered over 45-135 minutes at intensity of 143-19KV for different patients depending on the patients' sizes [1]. The sizes of patients varied from very obese with large bulk to slim built. Multiple x-ray examinations were also undertaken between the sessions in patients with multiple sessions.

Discussion

Extra-corporeal shock wave lithotripsy (ESWL) is a non-invasive therapeutic procedure designed and used for breaking down of urinary tract stones into small fragments using shock waves so that they can be easily excreted in urine [1,2,3,5,8,9]. It is a dramatic and highly effective alternative to both medical treatment, open and endoscopic surgery for renal stones (1,7,8,9). It was introduced into clinical practice in 1980 as an effective non-invasive interventional procedure (7). It is generally well accepted method of stone treatment although where there are large stones, many treatment sessions must be used to reduce the size of stone to such that can pass through the ureters without difficulty.

The complications associated with it had attracted researchers who focused on incompletely fragmented stones obstructing the ureters, and the effect of shock waves on the lung, skin (blisters), gastrointestinal tract mucosa (sloughing off, haemorrhage, diarrhea etc) and kidneys (haematuria) (4,5,8,9). However the use of long fluoroscopy time and multiple x-ray examination pointed to the important need to be conscious of radiation monitoring and protection in order to avoid adverse effect of radiation. This had received little attention until recently (6, 8,10,11)..

As at the time of ESWL at Okada, there were little or no radiological interventional procedures going on in radiology practice in Nigeria. Therefore radiation workers have concerned themselves with radiation protection practices in diagnostic radiology with little attention to the relatively new and often unperformed interventional procedure even though radiation effect is several folds more [8,10 -12]. In interventional radiological procedures and ESWL, the peak entrance skin dose is located medially where most of the vital organs and vessels are located[12]. Assessment of patient radiation dose and radiation induced stochastic effect (risk of fatal cancer) in a patient population is necessary for adoption of appropriate measures to reduce such risks in both the patients and staff. Such measures includes reduction in both the imaging time in procedures using fluoroscopy and reduction of number of exposures in diagnostic radiolog [10 - 13].

Only the basic protective lead gloves and lead aprons were used by radiologists and other doctors in the ESWL in Okada. The fact that there was no radiation monitoring of staff and patients reflects poor radiation protection practices during the procedure.

Even though researchers have tended to support the near zero or the zero presence of deterministic effect that requires minimum amount of dose (threshold dose) in ESWL (4,5,8), the stochastic effect caused by DNA damage and induction of malignant and hereditary diseases cannot be excluded and may actually be high due to long fluoroscopy time [13, 14]. Several factors which lead to extended fluoroscopy time were recorded in ESWL at Okada including multiple renal stones, multiple treatment sessions, large stones, staghorn calculi and large patient build [1, 4, 8, 9]. All these mean that radiation exposure to both the patients and doctors needed to be monitored during the ESWL at Okada. Reduction in radiation therefore needs adequate patient positioning, alteration of the procedure and addition of radiation filters [13-15].

The eagerness and zeal of radiation workers to prevent and reduce unnecessary radiation from getting to the patient and staff, radiation monitoring and practical approach to the procedure with the aim of reducing fluoroscopy time will lead to the "as low as reasonable achievable" principle of radiation protection [5,8,10,11,13,14,15]. Nigerian radiation workers need not suffer from cancer before they learn to prevent cancer both in our generation and in the generation to come. At the time of the ESWL in Okada, there was already some degree of radiation monitoring of both the staff and patient in Nigeria [16]. It is saddening to note that after heavy expenditure on investment, little attention is paid to the safety of health workers using the equipments.

In conclusion, there was laxity in the part of personnel involved in the first extra-corporeal shock wave lithotripsy regarding radiation monitoring. Extended fluoroscopy time as well as multiple treatment sessions with multiple x-ray examinations which increased both the patients and staff radiation exposure were noted. The use of lead apron and lead gloves were adopted. Proper monitoring of patients and staff is necessary to avoid risk from low-level exposure to radiation.

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