DO HAND SURGEONS TAKE A RISK BY USING X-RAY SCREENING?

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ÖZET:

EL CERRAHLARI RÖNTGEN IŞINLARI KULLANDIKLARINDA BİR RİSK ALIYORLAR MI?

Amaç: Radyolojik değerlendirme el cerrahisinde sıklıkla kullanılmaktadır. Bu durum beraberinde cerrahların giderek artan bir oranda, X ışınına maruz kalmalarıyla sonuçlanmaktadır. Bu çalışmada üst ekstremite cerrahisi sırasında gerek floroskopik ve gerekse grafi çekimi sırasında cerrahın almış olduğu doz miktarı prospektif olarak araştırılmıştır.

Materyal ve Metod: Üç ay süreyle 37 üst ekstremite cerrahisinde, floroskopi ve/veya radyografinin kullanımı sırasında biri cerrahın yakasında ve diğeri de gaz steril edilip çekimler sırasında cerrahın dominant elinin yanında olmak üzere 2 adet dozimetre kullanılmıştır. Cerrahi işlemlerin sayısı ve tipi, floroskopi ve/veya direkt radyografi kullanımları ve süreleri kaydedilmiştir. Aylık olarak dozimetrelerin ölçümü yapılmıştır.

Bulgular: Çalışma sonunda yaka üzerindeki dozimetredeki toplam doz 11 milirem ve cerrahın dominant elinin yanında bulunan dozimetredeki toplam doz 19 milirem olarak bulunmuştur.

Sonuç: Çalışmada elde edilen sonuçlar Avrupa Radyasyon Koruma Komitesi tarafından yılda alınabilecek maksimal doz olan 5000 mrem değerinin oldukça altında bulunmuştur. Bununla birlikte düşük dozda uzun süreli uygulanan X ışının etkileriyle ilgili çalışmalara ihtiyaç vardır. Zararlı etkileri en aza indirmek için gerekli korunma tedbirlerinin alınması gerekir.

Anahtar Kelimeler: *Mesleki maruziyet, radyasyon dozu, ortopedi.*

SUMMARY

Purpose: Because radiographic assessment is oftenly used during hand surgery, hand surgeons are in a rising risk of radiation exposure. In this study, the radiation exposure taken by the hand surgeon during the surgical procedure was prospectively investigated.

Material and Methods: Two dosimeter badges were used in thirty-seven consecutive operations in which either x-ray or fluoroscopy was used at three months time period. The surgeon wore a universal film badge on the collar and a gas-sterilized universal film badge dosimeter which was placed near the dominant hand all through the operation. The type and quantity of the surgical procedures, fluoroscopy or x-ray usage and time consumed during exposure were recorded. Dosimeter badges were measured at monthly intervals.

Results: At the end of the study the total exposure counted by the badge on the collar was 11 mrem whereas the exposure counted by the badge nearby the surgeons hand was 19 mrems.

Conclusion: Our findings showed that the measured intraoperative radiation exposure to the hand surgeon were well below the recommendations of the European Committee on Radiation Protection for maximal permissible dose which is 5000 mrem/year. On the other hand, studies concerning the influence of low-dose in long period radiation exposure has to be done. In addition, appropriate shielding precautions should continue to lower the harmful effects.

Key Words: *Occupational exposure, radiation dosage, orthopaedics.*

INTRODUCTION

The modern hand surgery practice involves increased exposure of the surgeon to ionizing

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radiation[1]. However, the risk of intraoperative radiation exposure for hand surgeons has not been well documented. Procedures under fluoroscopic and radiographic assistance are important in decreasing the devitalization of soft tissue by lessening the operation time. However, one potential hazard for the surgeon is increased exposure of the body especially the hands to radiation. It's well known that ionizing radiation can produce biologic damage[2,3].

The purpose of this study was to determine the risk to the hand orthopedic surgeon who assumes radiation for 3 months in operating room.

MATERIAL and METHODS

In this study we prospectively investigated 37 upper extremity orthopedic procedures performed under fluoroscopic and/or radiographic assistance prospectively. Dosimeter badges (Siemens® Gammasonics, Germany), which have an established sensitivity range of one mrem to 400 rem, were used to measure occupational radiation exposure in the operating room. The primary surgeon wore a universal film badge on the collar and a gas-sterilized universal film badge dosimeter which was placed near the dominant hand during the operation. In every operation, the same surgeon used same universal film badges. Standard fluoroscopic techniques were followed. We used C-arm fluoroscopy unit (SM7-HF, sias, spa, Bologna, Italy) and a standard portable X-ray unit (Mobigraf 2, Type 5628, Elektronska Industrija, Yugoslavia). The fluoroscopic and radiographic techniques were adjusted by the same radiographic technician and ranged from 55-68 kilovolt peak, 1.7 to 3.3 mA/sec for fluoroscopy, and from 53-70 kilovolt peak, 1.3 to 3.7 mA/sec for radiography, depending on extremity size and visualization.

At monthly intervals, the radiation doses were measured in milirem and recorded. The number and types of surgical procedures, during the portable C-arm fluoroscopy unit and the portable radiographs used, were recorded. Time elapsed during fluoroscopy usage was read directly from the machine and noted. Table I shows the number and type of operations, the number and time elapsed for fluoroscopic procedures.

The universal film badge on the collar for whole-body exposure and the badge near the dominant hand during X-ray exposure to radiation were monitored for exposure of the hands. The control badges used for quality assurance were kept separately and not subjected to any radiation.

RESULTS

The readings were found to be within the stated accuracy. Readings from the universal film badges on the collar showed a total cumulative exposure to radiation for the duration of the study was 11 milirem. The reading from the universal film badge that placed near the dominant hand was 19 milirem.

DISCUSSION

X-rays are high-energy forms of electromagnetic radiation that can harm living matter as a result of transfer of energy to molecules in the path of the radiation. All the types of ionizing radiation are dangerous and most important effects on human body are carcinogenesis and genetic damage. It has been suggested that the risk of developing leukemia increases after low-dose

Table I
Number and type of operations and, number of radiographic and image intensifier control in operating room during three months

Total number of operations	Type of Operation	Total number of radiographic controls	Total number of image intensifier controls	Total time of radiation exposure (sec)
5	Metacarpal fracture	12	3	10
4	Scaphoid fracture	8	6	19
7	Distal radius fracture	14	12	42
11	Both bone forearm fracture	22	3	14
3	Ulna fracture	6	–	
5	Radius fracture	10	2	11
2	Perilunate dislocation	5	6	17

radiation exposure obtained from diagnostic roentgenographic examinations[1].

The minimum safe distance differs from 46 to 90 centimetres in different studies[2-4]. In our study, the surgeon was always near by the patient and his dominant hand was directly related with the X-ray beam and the dosimeter badge was always near the hand. On the other hand, badge on the collar was seventy-five cm away.

Goldstone et al.[5] and Arnstein et al.[6] measured the radiation exposure to the hand and found out that the extremities receive much more radiation. Our study differed from their studies in the methodology because we evaluated not only the fluoroscopy but the conventional X-rays which is a well-known potential hazard for the surgeon also took into consideration. But our measurements are similar with them, supporting their results.

Our findings showed that the measured intraoperative radiation exposure to hand surgeon was well below the recommendations of the European Committee on Radiation Protection for maximal permissible dose (5000 mrem/year)[7] (Table II). This does not mean to quit safety measures when using radiation in the operating room. It has to be kept in mind that low dose ionizing radiation can lead to morphological and functional damage of the dermal microcirculation[8]. So in every clinic, which is concerned with the upper extremity surgery, intraoperative radiation exposure to the surgeon should be monitored continuously and the hand surgeons should continue to use appropriate shielding precautions in view of the unknown long-term risk.

Table II

Basic radiation exposure limits according to european committee on radiation protection

Type of Exposure	Limit
Whole body	5000 mrem Per year
Skin	30000 mrem Per year
Lifetime whole body	5000 mrem
Pregnant women	500 mrem in gestation period
Hands and forearms	75000 mrem Per year

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