



# Spinal trauma and role of radiographers in emergency radiography

Chauhan Ritu<sup>1</sup>, Sharma BB<sup>2</sup>, Rizwan Mir<sup>3</sup>

<sup>1</sup> Assistant Professor, School of Paramedical Sciences, Starex University, Gurugram, Haryana, India

<sup>2</sup> Professor and HOD, Faculty of Medicine and Health Sciences, SGT University, Gurugram, Haryana, India

<sup>3</sup> Assistant Professor, Faculty of Medicine and Health Sciences, SGT University, Gurugram, Haryana, India

## Abstract

**Purpose:** The aim was to assess the spinal trauma and role of radiographers in emergency radiography

**Methodology:** An observational study of spinal trauma and role of radiographers in emergency radiography was conducted for 5 months. During this period observation of radiographers was done during the handling of spinal trauma patients. Image quality was also observed in this study. Patients were taken randomly of all the spines.

**Result:** A study was conducted in the department of radiology at SGT hospital to observe the spinal trauma and role of radiographers in emergency radiography. Total 25 spinal trauma patients were taken in this study. Out of which 18 (72%) were males and 7 (28%) were females. More no. of injury was caused by RTA. Maximum number of patients were transported from the stretcher (n-12, 48%). Hence, transferring of patients with bedsheet (7 patients, 28%) was the common transferring method. AP and lateral views (n-20, 80%) were taken in most of the patients. Image quality was affected by the grainy appearance of image in 5 (20%) and metal artifact in 5(20%) patients radiograph. In many patients (n-7, 28%) radiographers didn't use marker and exposure factors were some high. However, rejection of film was very less. Most common injuries were anterolisthesis and parsinterarticularis defect in 2 (8%) patients.

**Conclusion:** In this study, it was found that the radiographers have proper knowledge about the handling of patients from transportation to taking of radiographs. They used stretcher for transportation of patients while leaving the department and used bedsheet for transferring of patients. They also used protective devices and immobilisation devices during taking radiographs. They took translateral view in seriously injured patients. This study shows that image quality was affected by the grainy appearance of image and metal artifact. In many patients radiographer did not use marker. But the number of rejection of radiographs was very less. Exposure factors were some high.

**Keywords:** patient, spinal, trauma, radiographers, emergency, radiography, image, quality, handling, radiology

## INTRODUCTION

Spinal injury is the severe injury which affects the various body functions. Spinal cord transfer nerve signals from the brain to the different parts of the body. Traumatic spinal cord injuries occurs due to the physical force applied on the bony vertebral column<sup>1</sup>. Moreover, spinal trauma that is responsible for the lesion of cord is often blunt trauma in which there are multiple injuries occurs in the structures which is related to it<sup>1</sup>. Injury to the spine leads to the permanent loss of body sensation and physiological functions below the level of injury. Different types of injuries are fracture, compression, dislocation, crushing and tearing that occurs in spinal canal, spinal cord, spinal nerve, ligaments and IVD. Trauma may lead to the injury in any spine. Nevertheless, cervical spine injury is the severe injury that occurs more frequently in case of major trauma. The various causes of spinal injuries are road traffic accident (RTA), fall from height, assault.

## Responsibility of radiographer in spinal trauma

Radiographer plays an important role in radiology department from handling of patient to taking of radiographs. Proper management of spinal trauma patient can lead to the reduction of further damage in future<sup>3</sup>. Safely transferring of patient from wheelchair or stretcher to the examination table is a very challenging task. Transferring of patient is done by one, two, three or four attendants from stretcher to the x ray table and cruch method. Some patients are self ambulatory who don't need any support for movement. Moreover, proper positioning is also very important to take the radiographs of spinal trauma patient. Improper positioning of patient may lead to the artifacts and in that case repeat radiographs might be taken. Hence, to avoid artifacts immobilization devices should be used, proper positioning of patient must be done, proper exposure factors must be used and all metals should be removed from the ROI. Various types of immobilization devices are foam pads, pillows, bed sheets, sandbags, adhesive tapes, cervical collars, backboard etc.

## Role of radiography in spinal injury

Since, radiographic views have special role to find out the type of injury in spine. So correct radiographic views should be taken in case of injury. Correct radiographic views helps in diagnosis of problem very clearly. In cervical spine trauma patient, three views (AP, lateral and odontoid views) should be taken<sup>2</sup>. In the trauma of thoracic, lumbar, sacrum, coccyx spine two views are taken (AP view and lateral view)<sup>2</sup>. In case of severe trauma if patient is seriously injured and not able to move then translateral view may be taken instead of lateral view.

## Quality of radiographs

Image quality play a vast role in finding of disease correctly. Good quality radiographs of spinal trauma patient are very important to find out the injury. Reject analysis is described as the critical evaluation of radiographs which are used as the part of imaging service<sup>3</sup>. Rejection of radiographs more often leads to the retakes which increases the unnecessary patient radiation dose and also increases the occupational and processing cost. Such analysis of rejected images gives an overview of the sources of radiographic errors and forms the basis for educating individual technologist<sup>3</sup>. There are various parameters that determine the quality of radiographic images like density, contrast, noise, sharpness, grainy image, resolution, distortion, blurring of image and artifact. In some studies images can be blur which is so far related to the spatial resolution. Collimation of beam should be enough to cover the ROI.

## AIM

This study is done to assess the spinal trauma and role of radiographers in emergency radiography in department of Radio-Diagnosis at SGT Hospital.

- To assess in the handling of patient with spinal trauma.
- To study the image quality of different radiographs in spinal trauma patient.

## MATERIAL AND METHOD

Research design and methodology are fundamental aspects of the research process. These should be selected cautiously because the success of a research project relies heavily on them. This was an observational study that was done by including 25 spinal trauma patients who came into the department for their diagnosis at SGT hospital. In this study researcher observed the radiographer way of handling of spinal trauma patient and observed the image quality of radiographs as well. All spinal trauma patients were taken in this study, which were taken by the convenience sampling method as the sample was taken from the section of population which was easily accessible or readily available to the researcher. In this study patients were taken randomly and then the mode of injury, mode of transportation of patient when they reported and left the department, transferring method, immobilization, use of protective device, exposure factors, image quality and rejection of films were observed. Handling of patient and image

quality in the radiology department depends upon the radiographer education. 5 months data was collected in the department of radiology. Data was collected from 1<sup>st</sup> November 2020 to 31<sup>st</sup> March 2021. Data is filled and expressed in excel sheet. A masterchart is also made. All spinal trauma patients of every age group in emergency department were included in this study. OPD patients were also included. Patients who were not in fit

condition to undergo radiography and post operative patients were excluded. Average mean, relative percentage and standard deviation are calculated in this study. Data is represented by using pie chart, bar graph, line chart and tables.

## Sample Size

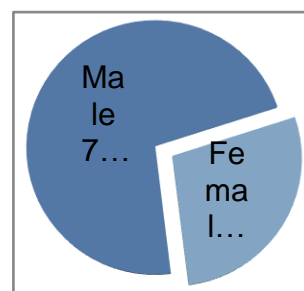
The sample size was taken in SGT Hospital and Research Institute. Table 1.1 shows the sample size of this study

Part of examination	No. of patients
C Spine	8
L-S spine	13
Coccyx	2
D Spine & L-S Spine	1
C Spine & L-S Spine	1
Total	25

Table 1.1 Part of examination and no. of patients

## RESULT

Twenty five spinal trauma patients were identified in this study. Out of 25 patients, 18 (72%) were males and 7 (28%) were females. The mean age of these patients was 31.04 years (age range 15-65) and mean  $\pm$ SD was 31.04  $\pm$ 11.8 years. Mean age of females and males was 32 years (age range 18-55 years) and 30.6 years (age range 15-65 years) respectively. Mean  $\pm$ SD in females and males was 32  $\pm$ 12.1 years and 30.6  $\pm$ 12 years respectively. Among them large number of trauma was noticed in the age group of 21-30 years (n - 11, 44 %).

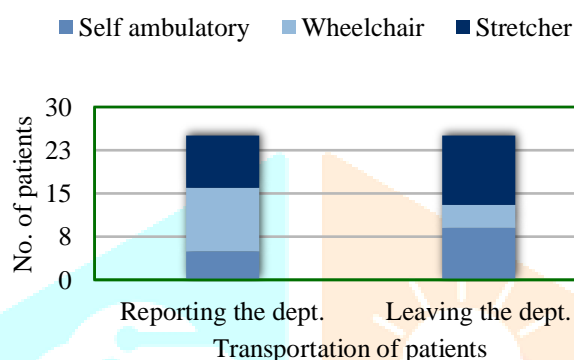


Graph 1.1 Ratio of gender and no. of patients

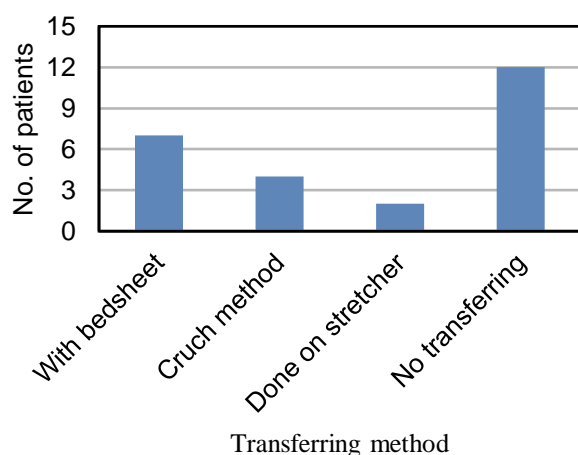
Most common mechanism of injury was RTA (n - 11, 44%). Maximum number of patients were transported from stretcher (n - 12, 48%) and minimum no. of patients were transported on wheelchair (n - 4, 16%) while leaving the department. Among 25 patients 9 patients (36%, age range 19-38 years) were self ambulatory, 4 patients (16%, age range 30-55 years)

were on wheelchair and 12 patients (48%, age range 15-65 years) were on stretcher. The no. of patients who were on stretcher while reporting the department was 9 (36%), on wheelchair 11 (44%) and self ambulatory 5 (20%).

Graph 1.2 Transportation of patients while reporting and leaving the department



There were various methods used by the radiographers for the transferring of patients. 7 patients (28%), age range (18-65 years) transferred by the help of two attendants. In 12 patients (48%) no any support was provided for transferring. In 2 patients x ray was done on stretcher. In 7 patients (28%) support was provided to immobilize the patients and for the comfort of them and rest of the patients didn't need any support for immobilization. Protective devices were given to the patient to avoid unnecessary radiation dose. In 1 reproductive age female patient lead apron was used to decrease radiation dose who underwent for C-S examination.



Graph 1.3 Shows the transferring method with no. of patients

AP and lateral views were the commonest views which were taken together by the radiographers and translateral

view was taken in 2 patients as they were not able to move. AP and lateral views were taken in 20 (80%) patients, AP and translateral views were taken in 2 (8%) patients. In 2 (8%) patients only AP view and in

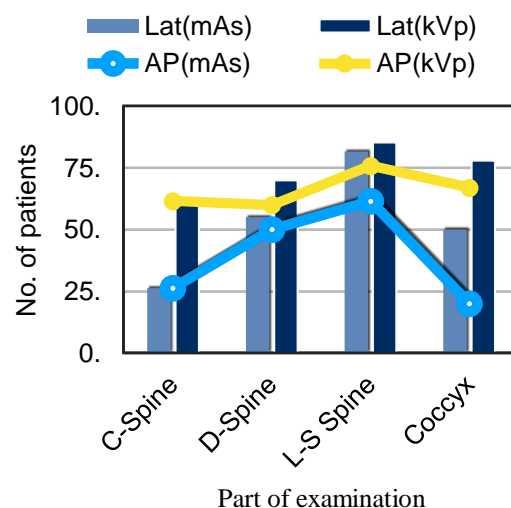
1 (4%) patient only lateral view was taken as shown in Table 5.7.

Views	Frequency
AP&Lat	20
AP&Translat	2
Only AP	2
Only lat	1

Table 1.2 Radiographic views and no. of patients

Exposure factors plays an important role in taking radiographs which depends upon the understanding of radiographers. Factors are adjusted manually in CR system which is in our department according to patient thickness and part which is to be examined. The range of mAs and kVp in C Spine was 16-40 (mean exposure value 26.4, Mean  $\pm$ SD is 26.4  $\pm$ 6.94) and 50-68 (mean exposure value 61.6, Mean  $\pm$ SD is 61.6  $\pm$ 5.59) respectively in AP & Lat view both. In D-Spine mAs and kVp was 50 and 60 respectively in AP view, 55 and 70 respectively in lat view. In L-S Spine range of mAs and kVp was 40-100 (mean exposure value 61.6, Mean  $\pm$ SD is 61.6  $\pm$ 15) and 70-88 (mean exposure value 75.8, Mean  $\pm$ SD is 75.8  $\pm$ 6.58) respectively in AP, 54-130 (mean exposure value 81.7, Mean  $\pm$ SD is 81.7  $\pm$ 26) and 80-96 (mean exposure value 85.2, Mean  $\pm$ SD is 85.2  $\pm$ 4.79) in lateral view. In coccyx range of mAs and kVp was 20 and 67 respectively in AP view and 20-80 (mean exposure value 50) and 66-90 (mean exposure value 78) respectively in lateral view.

Graph 1.4 Comparison of average mAs & kVp in AP and Lat view

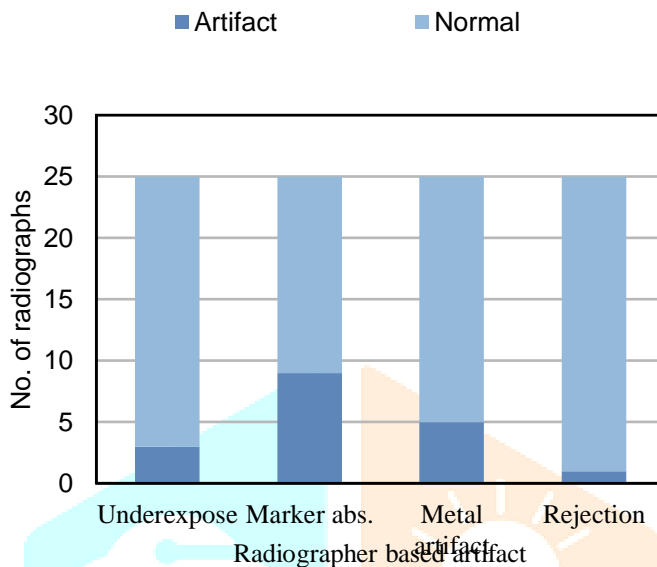


Out of 25 patients radiographs, 3 (12%) radiograph was underexposed. In 9 (36%) radiographs, radiographer

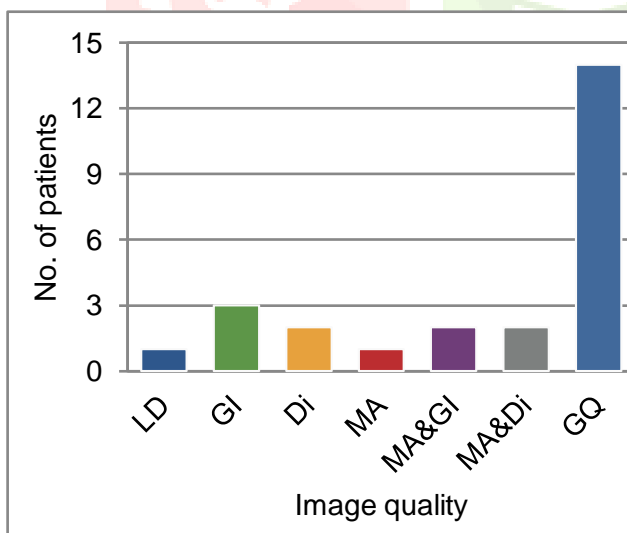
didn't use marker, in 5 (20%) radiographs metal artifact was arisen. One radiograph was rejected.

Graph 1.5 Shows the artifact and rejection of radiograph

In this study, out of 25 patient's radiographs 14 (44%)

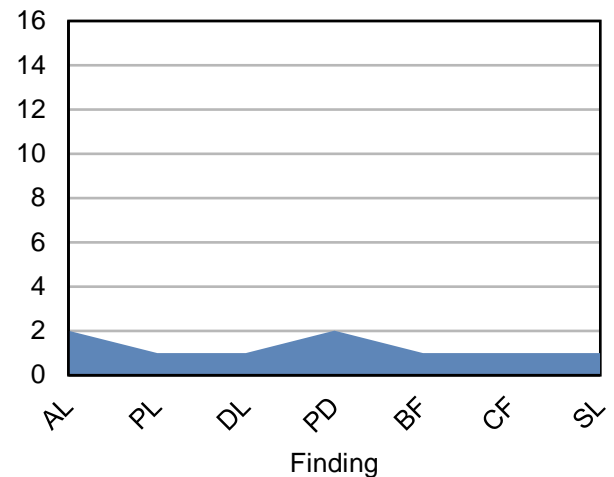


radiographs had good image quality, 1 (4%) radiograph had low density, 3 (12%) had grainy image, 2 (8%) had distortion, 1 (4%) radiograph was degraded due to metal artifact, 2 (8%) had both metal artifact and grainy image and 2 (8%) radiograph had both metal artifact and distortion. Most of the image quality was affected due to appearance of grainy image and metal artifact was arisen as shown in Graph 5.11



LD- low density  
GI- grainy image  
Di- distortion  
MA- metal artifact  
GQ- good quality

Graph 1.6 Shows the image quality of radiographs



In this study there were many injuries that were found. As shown in Graph 1.7 Anterolisthesis and parsinterarticularis defect were the common injury that were found in two patients.

AL- Anterolisthesis  
PL- Posterolisthesis  
DL- Dislocation  
PD- Parsinterarticularis defect  
BF- Burst fracture  
CF- Compression fracture  
SL- Spondylolisthesis

Graph 1.7 Findings in spinal trauma radiographs and no. of patients

## DISCUSSION

Radiographer has most important role while handling and transferring of spinal injured patients to prevent the secondary injury. The purpose of this study was to observe the radiographer during handling and transferring of spinal trauma patients and to know about the education they have related to handling them like transportation method, transferring method, immobilization, protective device, exposure factors and taking of good quality radiographs. Immobilization is a crucial step in management of unstable spinal fractures. Cervical collar was the common immobilization method which was revealed in several studies conducted by



Conrad et. al., Kreinst et. al., Corbacioglu et. al.<sup>4,7,8</sup>. In this study bedsheet and hand support were provided to immobilize the patients. Since, most of the patients were on stretcher that's why large number of patients were transferred with bedsheet from stretcher to the x ray table (n - 7, 28%) or vice versa with the help of two persons. The study was carried out by Conrad et. al. in which transferring of patients was also done by two persons<sup>4</sup>. Further research was conducted by Beneke et. al. in which radiographers took lateral and peg views in spinal injured patients<sup>5</sup>. In this study AP and lateral views (n - 20, 80%) were the common views that were taken together. However, translateral view was also taken in those patients who were seriously injured and not able to move for taking lateral radiographs. Image quality play a vast role in finding of disease correctly. If image quality is good then finding of disease will be correct and if the image quality is poor then it might lead to the misdiagnosis. Good image quality depends upon various factors. Quality of radiographs can be

degraded by motion of patients, grainy appearance, metal artifact, overexposed or underexposed of film. In this study there were some radiographs in which metal artifact was appeared, some radiographs were underexposed and, some radiographs were grainy, there were many patients in which they did not apply marker, but the good thing was the number of rejection of radiographs were very less. The previous studies by Charlene et. al. and Anderson et. al. researched to find out the cause of rejection of images and rejection rate in which number of rejection of images were more and most common reason of rejection was miscentering of patients<sup>6,3</sup>. In the present study only one radiograph was rejected by the radiographer due to underexposure. Moreover, the most common reason of degradation of images was grainy appearance of images and metal artifact.

## CONCLUSION

In the present study, it was found that the radiographers have proper knowledge about the handling of patients from transportation to taking of radiographs. This study shows that large number of radiographs were degraded due to the grainy appearance of image and metal artifact. In many patients radiographer did not use marker. But the number of rejection of radiographs were very less. Exposure factors were some high. Radiographer should use marker and less exposure factors and avoid metallic objects from the area of examination.

## Contributors

All authors contributed to the conception or design of the work, the acquisition, analysis, or interpretation of the data. All authors were involved in drafting and commenting on the paper and have approved the final version.

## Funding

This study did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## Conflict of Interest

The author has no conflict of interest.

## Disclosure

The author did not receive any type of commercial support in forms of either compensation or financial support for this study.

Ethical approval & Informed consent was obtained from all participants.

## REFERENCES

1. Bellet FD, Rashid SM, Jusabani MA, Dekker MC, Temu RJ *et. al.* The characteristics of cervical spinal cord trauma at a North Tanzanian Referral Hospital: a retrospective hospital based study. *Pan African Medical Journal*; 2019; vol-33; p 82
2. Guarnieri G, Izzo R, Muto M. The role of emergency radiology in spinal trauma. *The British Journal of Radiology*; 2016; vol-89; p 1061.
3. Andersen ER, Jorde J, Taoussi N, Yaqoob SH, Konst B, Seierstad T *et. al.* Reject analysis in direct digital radiography. *Acta Radiologica*; 2012; 53(2),174–178.
4. Conrad Bryan P, Rechtime Glenn, Weight Mark, Clarke Joanne Marybeth H *et. al.* Motion in the Unstable Cervical Spine During Hospital Bed Transfers. *The Journal of Trauma: Infection, Injury and Critical Care*; 2010; 69(2); 432-436
5. Baneke A, Shafei R, Costello J *et. al.* A retrospective analysis of cervical spine radiography in a specialist trauma unit for head injury. *Emergency Medicine Journal*; 2012; 29(12); 995-997.
6. Charlene B, Christine DK, Edwin RD, Amkongo M, Nabasinja C *et. al.* South African Radiographer - The causes of reject images in a radiology department at a state hospital. *African Journal*; 2018; Vol-56; 35-39
7. Kreinest M, Goller S, Rauch G, Frank C, Gliwitzky B, Wofl CG *et. al.* Application of cervical collars – an analysis of practical skills of professional emergency medical care providers; 2015.
8. Corbacioglu S, Akkus S, Cevik Y, Akinci E, Uzunozmanoglu H. *et. al.* Effect of spinal immobilization with a long backboard and cervical collar on the vital Signs. *European Journal of Emergency Medicine*; 2016; 15(2); 65-68.