



Research Paper

DESIGN AND DEVELOPMENT OF MODIFIED MATTRESSES FOR PATIENT HANDLING

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In present investigation, we see that in hospital, patient transfer from one place to another place that time require labor intensive work. Sometime during handling, patient and hospital staff suffer from many problem like stresses are produced in the body, some time chances to sleep down the patient. It is required to eliminate all types of possibilities. The present research work proposes a design and development of modified mattresses. By using such type of modification we can totally eliminate the problem occur at the time of handling of patients.

Keywords: Modified mattresses, Stretcher, Hospital bed

INTRODUCTION

In hospital we see that patient handling were from one place to another for further checkups. As per the demand for better living quality of immobilized patients, hospital bed should be improved accordingly. Transferring of immobilized patients is usually the work of nursing staff. Transfer of patients from one place to other place is a labour intensive work. It is very strenuous for nurses and dangerous for patient, if inappropriate operational procedure is used. Most of the hospitals are using fully atomized beds and stretcher for the above purposes. There are very costly and cannot be affordable to all the hospital. The

stresses developed during the handling of patient in both, i.e., patient and staffs are same for all the hospital. Our aim to provide a better solution for patient handling to these hospitals who are having limitations for the use fully automated beds and stretcher.

According to a recent survey, it is found that, 38% of nursing staff suffers work related back injuries requiring time away from work, 12% of nursing staff considers leaving nursing due to low back pain at average age 39. Nursing staff aides have also experienced significant injury.

The present research work proposes Assembly of a new trolley along with the

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modification of mattresses which will totally eliminate the manual handling of immobilized patients.

IDENTIFICATION OF PROBLEM

Present Method of Patient Handling

The patient transfer from Ambulance to O.T./ICCU/X-ray centers/MR scan/Sonography can be proceed through various stages.

From Accident Spot to Stretcher

When accident is happen that time first patient. Transfer from accident spot to stretcher.

Stretcher to Ambulance

The patient is moved from stretcher to ambulance with the help of three to four persons.

Ambulance to Hospital Stretcher

When accidental case come in hospital after that patient transfer from ambulance to stretcher by using man power.

Stretcher to Bed at O.P.D.

Patient transfer from ambulance to O.P.D. ward by using stretcher. Patient is moved from stretcher to bed with the help of three to four persons.

O.P.D to ICCU/Ward Bed

Patient transfer another places by using stretcher with the help of man power as per the requirement like O.P.D. to ICCU/Ward bed.

From O.P.D. to X-Ray Centre/ MRI /SCAN/Pathology Centre

Patient transfer another places by using Stretcher with the help of man power as per

the Requirement like O.P.D. to X-Ray centre/ MRI/SCAN/Pathology centre.

Back to the Bed of ICCU/Ward Bed

The patient is moved back by reversing above steps.

Figure 1: Present Method of Patient Handling

Step 1



Step 2



Step 3



Figure 1 (Cont.)



Present Method of Patient Handling from Ambulance to Stretcher

This is the generalized method of patient handling adopted in hospital at the time of accidental case come in hospital.

THE PROBLEM ASSOCIATED WITH ABOVE PATIENT HANDLING

- When the patient is required to be moved on the same floor, he is wrapped in a canvas or cotton bed sheet and lifted by three to four person or nursing staff. Due to this handling, stresses are produced in the body of the patient as well as the nursing staff. This may result in injuries to the patient and cramp may be produced in backbone and other parts of the body.
- During the manual handling of the patient various accessories like oxygen supply, blood transmission facility, saline facility, are not available and this may create serious problem if the patient is serious.
- When the patient is to be moved from trolley to ambulance bed or to be moved on

staircase at hospital or CT scan or X-ray centre, the movement of the patient is on inclined plane and during this movement, there is a chance that the patient may slip or slide down on stretcher.

The above problems of handling of patient can be eliminated by developing a new trolley to handle the patients and modifying hospital bed.

LITERATURE REVIEW

The present patient handling done by using stretcher. The modern patient handling trolleys are provided with arrangement to push them into ambulance on a slant surface. No one mechanism is available in present patient handling system to prevent the manual transfer of patient from one place to another.

For the safely patient handling we proposed the assembly of trolley cum stretcher and modified hospital bed. While transferring the patient from hospital bed to trolley, the height of trolley is adjusted exactly to the height of sliding top of hospital bed and the aluminium slider with mattress is transferred/pushed to trolley channel housing.

This chapter reviews literature/work carried out by various research workers in the area of patient handling and trolley for facilitate patient handling.

Kevin Hsu *et al.* (2008) discusses a design of Portable Lift for Transferring Wheelchair Patients to Elevated Vehicle/ambulance. Moving wheelchair bound people from their chair into a vehicle is often time consuming. The process gets more complex when the patient has to be lifted out of the chair and into a truck with an elevated seat height.

The finding of this research shows final design is an air jack powered by car exhaust, or by an external air compressor. The jack is supported by a scissor lift frame which holds the jack in place and allows for uniform lifting of the tracks to correct seat height. The entire frame is made of aluminium, which is strong, lightweight, anti-corrosive and easy to machine. The device is designed so that the air jack carries a majority of the load, and the frame ensures the jack's stability. Additionally, the tracks have locking mechanisms to further hold the wheelchair in place.

Wei Ching-Hua *et al.* (2007) presents the mechanism: 1) to change the position of patient from lying to sitting, 2) to change the lateral position of patient, 3) to transfer the patient from main bed to stretcher or trolley.

The purpose of this design was both for reducing the physical loading of nurses, and for preventing from sequential illness, relieving the uncomfortable feeling of prolonged bed ridden patients. This proposed bed has easy operation features, which not only can provide patients to change position from lying to sitting or feet rising gesture, but also can assist nurses to change lateral position of patients and transport patients from one bed to the other bed.

The mechanical design concept of changing lateral position and transferring patient came from the transportation of patient by stretcher. This work revealed the functional mechanisms, they are: (1) Mechanism for assisting patient to rotate laterally that facilitate patient to change lateral position either right or left within the maximum angle by 80 degree and helps nurses to easily provide massage

on the back of patients. (2) Mechanism for assisting patient to transport laterally from main bed to the other bed or moving carrier such as wheelchair. (3) Mechanism on moving carrier such as gurney to transform into wheelchair that helps patients to easily get off the main bed and manoeuvre to locations, where the medical treatment or recreation purpose are desired.

Hongbo Wang and Fumio Kasagami (2008) present a Careful-Patient Mover used for patient transfer in hospital. Using this Careful-Patient Mover, the nurse can transfer the weak, injured or paralyzed patient from bed to stretcher or from stretcher to bed by oneself and the suffering, stress and uneasy feeling of the patient can be alleviated. This paper describes the purpose of development, design of mechanism and control system of the apparatus. A new servo system is used in this control system and its control principle and algorithm are proposed.

The evaluation results of validation trials indicated the effectiveness of the system.

It is well known that a large number of nurses suffer from lumbago pain because they must take the patient lying on beds up their arms to transfer them. Since the violent and careless transportation can cause the pain of the patient or an accident; the nurse must expend heavier work to transfer a patient than to transfer an object with same weight.

Shih-Wei Peng and Feng-Li Lian (2010) discusses the mechanism design and mechatronic control of a multifunctional test bed for testing and evaluating healthcare activities designed for assisting bedridden people. The test bed consists of a set of two

robotic beds: one main bed and one nursing bed. The main bed is designated for posture changing and the nursing bed is for transportation. Both beds are also equipped with a belt system for transferring the body between them. The design concept of the bed system is formulated based on the field study of similar apparatus in hospitals.

The two beds are then manufactured and controlled by a systematically designed mechatronic system and can be interacted through a specially designed graphical user interface program. Related experimental evaluations are illustrated extensively. The proposed test bed is designated for mechatronic engineers and healthcare personnel simultaneously to better assist the daily life of a bedridden person. The evaluation results indicate the effectiveness of the bed system.

Patient Care Ergonomics Resource Guide: Safe Patient Handling and Movement developed by the Patient Safety Centre of Inquiry (Tampa, FL) (2001), Veterans Health Administration and Department of Defence. The goal of this guidebook is to reduce the incidence and severity of job-related injuries related to patient handling and movement tasks. While there is much to learn about the science of safe patient moving and handling, the tools provided in their current form can serve as cognitive aids for both caregivers and patients. Derived from best practices within and outside health care, the program elements described in this guidebook have been tested within the Veterans Health Administration (VHA) and are being fully implemented on 25 nursing home care units and spinal cord injury units within VISN 8.

In this Guide in the Chapter 6 this report stresses about development of a No-Lift Policy for bedridden patients. The purpose of the policy is not punitive, but support of both staff and administration. This policy establishes expectations that staff will use the safest techniques to accomplish patient repositioning and that administration will provide equipment and resources to support staff efforts. If supervisors or peers observe direct care staff not following safe protocols for repositioning, this indicates that the staff member needs retraining. This policy is not to be used to discipline employees but to educate them.

Ehsanullah Khan *et al.* (2011) presents a conceptual development of trolley cum wheelchair for eliminating manual patient handling. The manual handling of patient is injurious to the patient as stresses are produced in the body of the patient, especially in neck, back bone, limb joints, etc., along with the basic medical problem he has. Improper handling may cause injuries to the patient. Also the nursing staffs who handles patients, faces some health problems like pain in the shoulder, back bone, etc.

For safety of the patient, the manual handling of patient should be totally eliminated. If trolley cum wheelchair, with adjustable height is available, once the patient is transferred to the trolley-cum-wheelchair from hospital bed, the patient will not be required to be handled manually till he reaches the CT scan/X-Ray centre. The paper presents a schematic design of trolley cum wheelchair and discusses its salient features and applications.

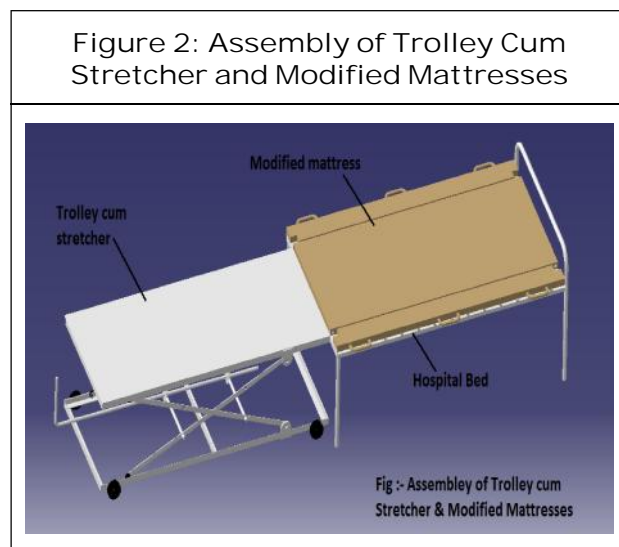
LITERATURE REVIEW

The literature review indicates that the patient handling method and equipment-trolley, trolley cum wheelchair is used presently cannot prevent the manual handling of patient from hospital bed to trolley/trolley cum chair to hospital bed. Though Wei Ching-Hua *et al.* (2007) proposed a system to transfer the patient from hospital bed to stretcher or vice versa. The proposed system is very complicated and costly and hence not suitable for use in hospital environments present in our country.

FORMULATION OF PROBLEM

As per the demand for better living quality of patients and safely transferring of patient we can improved the hospital mattresses. Transfer of patients from one bed to stretcher is a labour intensive work and which is very strenuous for nurses and dangerous for patient, if inappropriate operational procedure is used.

For safely transferring of patient we proposed the following assembly of trolley cum stretcher and modified mattress.



CONCLUSION AND FURTHER SUGGESTED WORK

Advantages of Trolley Cum Stretcher and Modified Mattresses

- It eliminate the problem occur during patient handling.
- It will reduce stresses on nursing staff.

Limitations of Trolley Cum Stretcher

- The cost of this project will be high as Hospital's owner has to replace all the conventional hospital bed with new one.
- Extra care has to take while moving the patient on Trolley cum stretcher.

CONCLUSION

As per the above description we concluded that now day Most of the hospitals are using fully atomized beds and stretcher for the patient handling. There are very costly and cannot be affordable to all the hospital. The stresses developed during the handling of patient in both, i.e., patient and staffs are same for all the hospital. Our aim to provide a better solution for patient handling to these hospitals whose are having limitations for the use fully automated beds and stretcher. As per the above problem we provide modified mattresses for patient handling. Cost of such type of mattresses is affordable for all type of hospital and it is beneficial for patient handling.

FUTURE WORK

- Design and development of trolley cum stretcher.
- Design and development of modified mattresses. 🌀

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