All Terrain Medical Stretcher

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Abstract

Generally used conventional stretchers have small wheels comparatively. They can be used on smooth, levelled and concrete surfaces. But they are not suitable for rough, gutter filled and earthy passages. So the usual practice is that, two or more people will lift the stretcher by hand and carry it. This practice is not reliable in all cases and it may cause discomfort to the patient as well as the persons handling it. Also there are chances that the patient may even fall down. So there arises the need for a project to overcome all these problems. The proposed project has all terrain wheels which make it suitable for carrying patients easily and comfortably through rough terrain, gutter filled paths etc. Also an efficient suspension system is provided so that the patient may feel comfortable throughout the travel. No matter what the path is the patient will experience them smoothly. Also other provisions like foam bed or gel pad may be provided to increase comfort. The proposed project finds wide applications in areas where ambulance or other vehicles could not reach like villages, forests, narrow lanes in streets and a lot more medical purposes. The proposed project is also light weight so that it can easily be lifted in emergency situations. The proposed project will ultimately help to reduce human effort, reduce manpower requirements and will provide superior comfort and care to patients.

Keywords: Light weight, Suspension, Comfort, Stretcher, Compact

I. INTRODUCTION

A stretcher, litter, or pram is an apparatus used for moving patients who require medical care. A wheeled stretcher is often equipped with variable height frames, wheels, tracks, or skids. In American English, a wheeled stretcher is referred to as a gurney. The name comes from a horse-drawn cab patented in the USA by J. Theodore Gurney in 1883 which bore a similarity to early wheeled stretchers. Stretchers are primarily used in acute out-of-hospital care situations by emergency medical services, military, and search and rescue personnel. Stretchers used in ambulances have wheels that makes transportation over pavement easier, and have a lock inside the ambulance and seat belts to secure the patient during transport. An integral lug on the gurney locks into a sprung latch within the ambulance in order to prevent movement during transport. Modern stretchers may also have battery-powered hydraulics to raise and collapse the legs automatically.

The word all terrain refers to designed to travel on all types of ground, including rough ground. The proposed project has all terrain wheels which make it suitable for carrying patients easily and comfortably through rough terrain, gutter filled paths etc. Also an efficient suspension system is provided so that the patient may feel comfortable throughout the travel. No matter what the path is, the patient will experience them smoothly. Also other provisions like foam bed or gel pad may be provided to increase comfort.

Generally used conventional stretchers have small wheels comparatively. They can only be used on smooth, levelled and concrete surfaces. Hence there is a need for finding an alternate for tackling the above problem. This problem can be rectified by using an all-terrain tyre. The stretcher is having the provision of shock absorber and effective suspension. So the shocks and abnormal vibration caused during travel in ambulance and through ground is reduced. These type of stretcher is finds many applications in areas where the direct access to ambulance is not achieved. In such situations these all terrain stretcher can be used as a substitute for carrying and moving the patient carefully and effectively. The stretcher is having the sufficient space for the placement of the lifesaving and sustaining devices, apparatus, medicines, emergency kits. The bottom space of the stretcher can accommodate the oxygen cylinders which can be used in the case of severe emergencies. The proposed project is a light weight so that it can easily be lifted in emergency situations. Besides our special steering mechanism and breaking system makes it possible for a single person to operate the stretcher. The proposed project will ultimately help to reduce human effort, reduce
manpower requirements and will provide superior comfort and care to patients. The material to be used is of light weight characteristic mainly aluminium or its alloys. The pan of the stretcher will be reinforced with light weight nylon composite so as to reduce the weight. The portions which are not loading bearing are to be constructed using light weight material such as plastic. The durability associated with this stretcher is provided prime importance. The effective mechanism for the entry and exit into and from the ambulance is under research. The effective locking mechanism that can suit the existing ambulance is under consideration and the further modifications can be given.

II. OBJECTIVE

The objective is to create a light weight, powerful and socially relevant all terrain medical stretcher which can overcome the conventional stretcher. In order to tackle the above mentioned objective the following measures are to be considered.
- Market survey
- Drawing of the model
- Prepare a CAD model
- Select the appropriate material
- Analysis in virtual environments
- Making of a prototype
- Testing

III. LITERATURE REVIEW

Emergency Medical Services (EMS) ambulance personnel provide medical care to out-of-hospital patients. The important roles of EMS include response to requests for 911 emergency help, rapid assessment and on-scene treatment of patients, and triage and transport of patients to appropriate receiving hospital facilities. Each year in the United States, EMS ambulances transport over 16 million patients to hospital emergency departments. A unique task in EMS ambulance care is the physical handling and movement of out-of-hospital patients. These essential functions include extrication of the patient, movement of the patient to the ambulance, transport of the patient to the receiving hospital and transfer of the patient from the ambulance to the receiving hospital bed or stretcher. These tasks may occur in cramped or unsafe locations such as the third floor of patient’s homes, shopping malls or even the wreck of a motor vehicle collision. The primary device used by rescuers for mobilising patients in the out-of-hospital environment is the wheeled ambulance stretcher.

Ambulance stretchers must be light (to facilitate field portability), strong (to handle large patient loads) and compact (to allow movement through cramped spaces). Modern ambulance stretchers contain mechanisms to facilitate a variety of key tasks such as movement, changing of stretcher height, and loading into and unloading from the ambulance patient compartment. A specialised fastening system secures the stretcher to the ambulance floor during transportation. While individual reports highlight adverse events associated with ambulance stretcher operation, there are presently no systematic descriptions of these incidents. Here, we characterise the nature of adverse events and associated injuries occurring during the operation of EMS ambulance stretchers.

The physical extrication, movement and transportation of out of hospital patients are integral components of EMS care. The ambulance stretcher plays an essential role in these tasks, facilitating the movement of ill or injured patients who are often incapacitated and unable to walk, sit or stand. The stretcher is also the primary device for securing the patient in the moving ambulance.

Gel pads are commonly used by occupational therapists in acute care settings to reduce pressure on the coccyx and sacrum in supine. Healthcare professionals are implementing new prevention initiatives and standards for pressure ulcer prevention. From a surge in recent research pertaining to pressure ulcers to the Medicare Guidelines that took effect in October 2008, the issue of hospital-acquired pressure ulcers is a popular topic for many healthcare professionals. Some new findings and statistics reinforce the need for multi-layer foam surfaces in the operating room environment where an estimated 23% of pressure ulcers in the hospital originate.

Gel pad is preferred over the foam bed because of the following reasons
- Constructed with an advanced silicone formula designed to help with pressure redistribution
- Easy-to-clean flexible membrane cover has shear characteristics similar to that of human skin
- Will not absorb body fluids or odours
- Radiolucent
- Repairable if punctured

IV. DESIGN, FABRICATION AND ANALYSIS

A. Catia Modelling:

The modelling was done using Catia V5 software. All the individual parts are modelled and then assembled. Computer aided design is defined as the use of computers in creation, modification, analysis and optimization of a design. Computer Aided
Engineering is referred to computers in engineering analysis like stress/strain, heat transfer, and flow analysis. CAD/CAE is said to have more potential to increase productivity than any development. They builds quality form concept to the final product. Instead of bringing in quality control during the final inspection it helps to develop a process in which quality is there through the life cycle of the product. CAD/CAE can eliminate the need for prototypes. But it required prototypes can be used to confirm rather predict performance and other characteristics. CAD/CAE is employed in numerous industries like manufacturing, automotive, aerospace, casting, mould making, plastic, electronics and other general-purpose industries.

Fig. 1: Frame

Fig. 1 shows the frame of all terrain stretcher.

Fig. 2: Assembled view

Fig. 2 shows the final assembled view of all terrain stretcher.

Fig. 3: Figure of fabrication

**B. Analysis:**

Analysis is done in ANSYS Software. The below figure shows the static load analysis done in Mechanical APDL (ANSYS) 14.0.
V. Conclusion

All terrain versatile stretchers will be an effective and economical substitute for the conventional ambulance stretcher which provides a considerable comfort for the patient as well as the person who directs the stretcher. The brakes and steering mechanism will help even a single person to effectively handle the stretcher. This project work has provided us an excellent opportunity and experience, to use our knowledge. We gained a lot of practical knowledge while doing this project work. In the future several modifications will be done. Our stretcher can be easily handled by even a female nurse alone. Sometimes it needed to transport patients from one building of hospital to another for surgery; scanning etc. and the path through which they are transported are often rough and uneven. If conventional stretchers are used for this purpose, it will cause very much pain and discomfort to the patients since conventional stretchers have small castor wheels. Our project has also very much relevance in civilian as well as military applications.

We aimed at developing a project which will prove to be a true asset and the best solution to some of the basic problems faced in our society. So we went to different hospitals to get feedback of our project idea. We got a very positive feedback and realized that our project was something which was essentially needed for hospital personnel. We also realized that it proved to be a best solution to all the current social problems faced by them. Thus it proved to be a very important socially relevant as well as innovative project.

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