



E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2021; 7(3): 25-27
© 2021 IJOS
www.orthopaper.com
Received: 16-04-2021
Accepted: 18-06-2021

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Inverted harness syndrome causing compartment syndrome: A novel mechanism of trauma: 1st reported in literature

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DOI: <https://doi.org/10.22271/ortho.2021.v7.i3a.2723>

Abstract

About 150 labourers died at the recent Chamoli Avalanche & Glacier Burst at Nanda Devi (Himalayan Ranges) in India. Thousands of labourers are injured due to occupational accidents daily of which many are fatal accidents take place every day in the machinery sector. Indigenous innovative methods devised to accomplish tasks at work are common in our country.

We report the case of a compartment syndrome sustained while using rope tied around the legs for Harness while climbing a coconut tree, termed as 'Inverted Harness syndrome' by authors due to analogy in mode to Harness syndrome but exactly opposite kinematics of injury. As described in the case report thorough work up by ATLS Protocol was done and finally the injury localized to increased compartmental pressure in both legs. After thorough investigation urgent fasciotomy was done. The outcome is good if the patient presents in time. To the best of our knowledge, this mechanism of injury hasn't been described in the literature so far.

Keywords: rope injury, inverted harness injury, compartment syndrome, harness syndrome, harness trauma

Introduction

In our motherland "India", dangerous accidents at manual labourer working sites are common. A study shows more than 350 million people at risk of injury from workplace-related accidents [1]. About thousands of labourers are met with fatal accidents at the workplace in India in the machinery and engineering sector [2]. Machinery site accidents are common due to disregard of safety norms for limiting costs while employing uneducated and cheap labor [3]. Indigenous innovative methods devised to accomplish tasks at work are common in most developing nations of the world. We report the case of bilateral compartment syndrome sustained while using rope tied around the legs for climbing a coconut tree in suburb of Kolkata. To the best of our research, this mechanism of injury hasn't been described in any study or text till now.

Case report

A gentle man aged around 40 years presented to the Emergency & Trauma Center with swelling and bruise on calf of both legs. He had tied a rope around his back and legs to climb up a coconut tree. Suddenly the rope around his back slipped and came down the tree and while slipping down the tree he got upside down with both legs trapped in the rope around the calf muscles and tree. Fortunately he did not fall off to ground getting life threatening injury; however his legs got entrapped high up in the rope. It took around 4 hours or more to arrange a Crane (elevator machine) to get him free from there (picture 1).

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Picture 1: Pic was accidentally taken just after the injury happened.

The primary survey appeared satisfactory however we had clinically positive Compartment syndrome affecting both legs. Patterned abrasion of rope injury was present below the calf muscle areas. (Picture 2A). Clinical examination of pain on passive stretch not responding to usual analgesics, pallor, paresthesia, feeble pulse and paralysis confirmed our diagnosis. Color Doppler added to our strong belief of proceeding for urgent fasciotomy after PAC. On exploration, the lateral and posterior compartment of thigh was damaged (Picture 2B). The idea to involve a vascular surgeon did work well at this time. (Picture 2C). Fasciotomy was done with

several skin incisions and all compartment released. Soft and moist dressing was applied. Patient was given limb elevation in post-operative period with analgesics and regular monitoring of saturation and movements in great toe. Restoration closure of wound was done at 14 days interval. Post-operative recovery was uneventful.

Case Discussion

Harness of body is required in industrial as well as adventure and sports activities. Harness syndrome results due to orthostatic hypotension during periods of prolonged suspension and is potentially fatal if the victim isn't rescued in time [4]. Falls from height occurs most commonly in the machinery industry, leading OSHA to make fall arrest systems compulsory at any site where vertical drop of 6 ft. or more is a possibility [5]. Industrial rope access is a regular practice in itself and much work has been done to promote safety [6].

However, workplace safety is ignored in our country [1]. Therefore, labourers come up with self devised unscientific ways to ensure safety. Harness using a rope tied around the waist is commonly practiced and can be seen at almost any machinery site [3]. Magnitude of energy imparted to tissues is exemplified by leg trapped causing compartment syndrome in both legs, and also it may cause spinal cord injury too. Besides, sudden flexion of the torso when slippage of the rope placed at the back may lead to flexion-distraction injury of the spine. Therefore, OSHA recommends attachment of body harness to be located in the center of back, near shoulder level or above head [5].



Picture 2 A: Patterned abrasion has become hazy after thorough scrubbing **B:** Identification of vascular status and planning of fasciotomy incisions **C:** Close picture of viable musculature post fasciotomy.

We were unable to discover any texts or publication with keywords like “rope harness injury, rope related injury, accidental rope injury, accidental hanging causing compartment syndrome of both legs, tie rope injury, injury due to sudden pull while harness”. Therefore, we firmly feel it to be the index report of such a mechanism of trauma. Due to the lack of adequate research, understanding mechanism would need lots of more research and explorations. Such situation may happen as in emergency aero plane evacuation, para jumpers and para gliders etc. case is missing in these neck Jiang et al. proposed their study on abdominal injury by seat belts. We suggest the term ‘inverted harness trauma’ due to a opposite kinematics in this case as compared to the ‘harness syndrome’ described many a times through several publications.

Learning Objectives

Inverted harness syndrome is a life threatening mechanism of trauma involving the transmission of huge amount of energy while fall or while getting a body part entrapped as in our patient. Workup to rule out all possible injury by ATLS protocol is advised. The prognosis is satisfactory if patient did report in time.

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