Evidence Based Practice Critically Appraised Topic

Spinal Immobilization & Pressure Ulcers

Amy Gotvaslee, RN, FNP-S

University of Mary

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Spinal Immobilization and Pressure Ulcer Formation

Case Study

A 49 year old male comes into the Emergency Room via ambulance after hitting a deer with the motorcycle he was driving. He estimates his speed at about 45mph. Patient can't remember exactly what caused the accident but EMS states that they found a dead deer nearby. The patient was wearing full leathers as well as a helmet. He is not intoxicated and is only complaining of left shoulder pain. The patient arrives to the emergency room in spinal immobilization.

Clinical Question:

In trauma patients, is there an increased prevalence of pressure ulcer formation between those placed in spinal immobilization compared to those not placed in spinal immobilization?

Articles:

Berg, G., Nyberg, S., Harrison, P., Baumchen, J., Gurss, E. & Hennes, E. (2010). Near-infrared spectroscopy measurement of sacral tissue oxygen saturation in healthy volunteers immobilized on rigid spine boards. *Prehospital Emergency Care, 14*(4), 419-424. doi:10.3109/10903127.2010.493988

Edlich, R.F., Mason, S.S., Vissers, R.J., Gubler, K.D., Thacker, J.G. Pharr, P., Anderson, M. & Long III, W.B. (2011). Revolutionary advances in enhancing patient comfort on patients transported on a backboard. *American Journal of Emergency Medicine, 29*(2), 181-186.

Summary and Appraisal of Key Evidence

Study 1:

Berg et al (2010), conducted an experimental study examining the effects of prolonged spinal immobilization on sacral tissue oxygenation StO_2 of healthy volunteers providing a Level 2, Grade B level of evidence. The study included seventy-three participants that were respondents to recruitment posters hung in various public locations around a university campus. Eligible participants were healthy volunteers aged 18 years or older not having a history of diabetes, smoking or extensive skin rashes over the spine.

Each volunteer's height and weight were measured prior to the study beginning. While in the standing position, each participant had three baseline measurements of tissue oxygenation taken prior to the intervention. These sites of measurement included:

1. At the intervention position (sacral area at the top of the buttocks)
2. At the local control position (area 8-10cm above the buttocks)
3. At the distal control position (the thenar eminence)

Tissue oxygenation measurements were taken by placing the near-infrared probe at the measurement site and waiting 15 seconds for equilibration.

Participants were placed supine on long rigid plastic spine boards and immobilized with buckled straps across their chest and legs for a period of 30 minutes. At the end of the 30 minutes, participants were log-rolled to one side and two StO_2 readings were taken: at the intervention position and the local control.

This study had several limitations including the measurement of tissue oxygenation. There was wide variability in StO_2 measurements. Near-infrared spectroscopy was not a useful study method for the evaluation of tissue oxygenation in pressure ulcer research because of low reliability. Also, this study was completed using healthy volunteers, therefore, cannot be inferred to populations such as diabetics, tobacco smokers, children and people with previous back injuries. More research may be beneficial in regards to the measurement of tissue oxygenation directly at the pressure site during the time of pressure as well as the exploration of variations in tissue oxygenation measurements of actual trauma patients who have compromised systemic responses.

Study 2:

Edlich et al (2011) conducted a comprehensive study of the Back Raft system that was designed to reduce patient discomfort and skin interface pressures providing a Level 2, Grade B level of evidence. The study included 10 healthy volunteers immobilized on a backboard and a backboard with a Back Raft air mattress system. Pressure under the occipital, scapula, and sacral regions of the back was measured using the Tactilus pressure analyzer.

The volunteers were placed horizontal on a wooden back board that was placed on a three foot high wooden assembly. The volunteers were studied for 30 minutes on a backboard without the Back Raft and then allowed off the board for 30 minutes to rest. They were then studied for a second 30 minute interval on a backboard with a Back Raft support attached. Level of pain was measured at baseline and at 15 minute intervals. At the end of each 15 minute interval, subjects were asked to assess the tested surface for comfort on a 10 point Visual Analog Scale. Interface or contact pressures between the subject and the board or Back Raft were measured at the occipital, scapula and sacrum with a Tactilus pressure evaluator. An average of pressure in millimeter mercury was obtained at each location at baseline and at 15 minute intervals.

Limitations of this study include the small number of participants which provides only a limited view of actual results. More research is needed in regards to skin interface pressures directly at the sites of pressure. Strengths include the use of the Tactilus pressure evaluator which limits variability and ensures accurate and invariable measurements.

Clinical Bottom Line

According to these studies, there is an increase in StO_2 of healthy volunteers after removal from a 30 minute immobilization on a rigid spine board. Also, interface pressure levels were significantly higher during the period of immobilization on a spine board. However, further research is needed to determine the true effects of immobilization on skin tissues. These studies are relevant today because most patients that arrive to an emergency room via ambulance are in spinal immobilization for transport. As indicated in these studies, even 30 minutes on a spine board in a healthy individual has the potential to result in skin breakdown.

Implications for Practice

The longer a pressure is in place, the greater the ischemic insult. While these studies involved healthy adults, many patients that arrive for care via ambulance are not healthy individuals which further potentiate these findings. I would recommend further guidelines for placement of spinal immobilization in pre-hospital transportation. There are many products that have been proven efficacious in providing more comfort, less tissue pressure and remain rigid for those patients that need full spinal immobilization. Further investigation is needed to provide a safe alternative to transportation with and prolonged spinal immobilization.

References

Berg, G., Nyberg, S., Harrison, P., Baumchen, J., Gurss, E. & Hennes, E. (2010). Near-infrared spectroscopy measurement of sacral tissue oxygen saturation in healthy volunteers immobilized on rigid spine boards. *Prehospital Emergency Care, 14*(4), 419-424. doi:10.3109/10903127.2010.493988

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