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Incidence of cervical collar-related pressure injury in patients with head and neck trauma: A scoping review study

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Abstract:

The use of the cervical collar to support the head and neck is inevitable in many patients with head and spinal cord injuries. One of the consequences of using this instrument is the development of pressure injuries. Therefore, in this review study, the incidence of as well as the risk factors for cervical collar-related pressure injury in this group of patients was evaluated. The current study is a scoping review conducted in 2022. Five scientific databases (PubMed, Scopus, Web of Science, ProQuest, and CINAHL), as well as Google Scholar, were searched for relevant studies published from 1990 to 2022 using the following keywords: trauma, spinal cord injury, head injury, head trauma, collar, cervical collar, cervical immobilization, risk factors, incidence, pressure injury, pressure ulcer, and bed sore. The search was performed independently by two researchers. Articles from the initial search were first recorded in special tables, and then, were reviewed and analyzed separately by two researchers. After extraction, information from each article was entered into a special table categorized by year, country, study design, study population, the incidence of cervical collar-related pressure injury, risk factors for cervical collar-related pressure injury, and grades of pressure injury. Of the 10 articles, 6 were retrospective cohort studies, 3 were cross-sectional descriptive studies, and 1 was a case report study. In terms of the study population, one study was conducted on pediatric patients, one was conducted on elderly patients, and eight were conducted on adults with head and neck trauma. In eight articles, the incidence of cervical collar-related pressure injury was reported. The reported incidence varied between 1.1% and 78.4%. In eight articles, risk factors for cervical collar-related pressure injury were reported. The most common risk factors were duration of cervical collar use, hospitalization in intensive care units, low level of consciousness, and longer hospital stay. The current review study showed that a significant percentage of head and neck trauma patients for whom cervical collar is used suffer from different grades of pressure injuries. Hence, healthcare providers should consider this issue when caring for this group of patients and take the necessary preventive measures in this regard. It should be noted that previous studies in this field had significant limitations, and thereby, it is strongly recommended to conduct further studies with a stronger methodology.

Keywords:

Head trauma, immobilization, medical device-related pressure injury, neck trauma, review, spinal cord injury

Introduction

Trauma is considered as the first leading cause of disability among the active population in developing countries and is

the second leading cause of death in both genders.^[1]

Spinal trauma is one of the most prevalent traumas of the central nervous system,

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which can be associated with a spinal fracture and spinal cord injury.^[2] Spinal trauma is a common occurrence in the United States, affecting 350 out of every 1 million people,^[3] and approximately one-third of these patients are diagnosed with an unstable spinal fracture or spinal cord injury. Spinal cord injury also constitutes about 23% of all spinal traumas.^[4] In Iran, based on the data registered in the National Trauma System, about 5.8% of admitted trauma patients have suffered traumatic spinal cord injuries.^[5]

Head and spinal cord injuries are a kind of injury that can be associated with remarkable problems for the patient involved. Its long treatment and rehabilitation periods, expensive treatment costs, and impact on one's daily functioning always pose a great burden on the patient, his/her family, and the community.^[6]

The costs of treating these new wounds are estimated at \$5000 per case.^[7] The financial cost to the health service is estimated at £4300–£6400 per patient.^[8]

In terms of the prevalence of spinal cord injury, its prevalence is reported to be 1 per 1000 people. In addition to acute complications, patients may experience chronic complications such as cardiovascular, respiratory, musculoskeletal, urinary, and skin disorders, which themselves have significant negative impacts on them.^[9]

One of the skin problems that a significant percentage of patients with head and spinal cord injuries may suffer from is pressure injury.^[9-12] In one recent study, it was reported that nearly 40% of patients with head and spinal cord injuries experience different grades of pressure injuries.^[13] Another study in 2022 showed that about 28 percent of trauma patients are confronted with some degree of pressure injuries.^[14] One type of pressure injury which has received special attention in recent years is medical device-related pressure injury.^[15,16] This type of injury occurs in the skin under the area where a medical device is applied for the patient and conforms to the pattern or shape of the device.^[15] Trauma patients are significantly at risk of developing such injuries. In one study, the incidence of medical device-related pressure injuries was reported to be 13% among patients with suspected spinal cord injuries.^[17] For most of the patients with head and neck trauma, it is necessary to use a cervical collar to support their head and neck.^[18]

Cervical collars are of very important value during spinal trauma. The application of cervical collars was verified in minimizing maximal movement at the cervical spine during trauma.^[19]

Preventative interventions for cervical collar-related pressure injury include removal of the extrication collar,

cervical spine clearance, nursing education, routine nursing care, use of products such as air mattresses, and a multidisciplinary approach to care.^[20]

Although collars are useful instruments for stabilizing/immobilizing the actual or suspected injury to prevent further damage in head and spinal cord injuries patients, their use can be associated with several consequences, one of the main of which is cervical collar-related pressure injury.^[20,21] These injuries can occur on the chin, in the occiput, mandible, laryngeal prominence, or even upper regions of the chest.^[22] Patients with pressure injuries are confronted with several bad experiences such as pain, body image disturbance, loss of individual independence, infection, and frequent hospitalization.^[23] In addition, the cost of pressure injury is very high. In one study in Australia, researchers reported the cost of pressure injuries in public hospitals was about \$9.11 billion.^[24]

When caring for the skin in patients with head and spinal cord injuries, great attention is usually paid to regular pressure injuries, which are mostly caused in the back and sacrum due to prolonged immobility, and less attention is paid to medical device-related pressure injuries. In this regard, previous studies also showed that these groups of patients are at great risk of such injuries, especially cervical collar-related pressure injuries. Having information with regard to the incidence of and risk factors for cervical collar-related pressure injury in patients with head and spinal cord injuries makes healthcare providers take preventive measures more carefully and with better planning. In addition, information in this field helps researchers for conducting necessary studies. Scoping review that is usually conducted to map the body of literature on a topic area is helpful in this regard. So, the current study was designed and conducted to review the relevant studies in this field.^[25] The current study is a scoping review aimed to review the studies about the incidence and risk factors of cervical collar-related pressure injury.

Materials and Methods

The current study is a scoping review aimed to review the studies about the incidence and risk factors of cervical collar-related pressure injury.

Scoping reviews are used to present a broad overview of the evidence pertaining to a topic, irrespective of study quality, and are useful when examining areas that are emerging, to clarify key concepts and identify gaps. Scoping reviews are a relatively new approach to evidence synthesis and are now seen as a valid approach in those circumstances where systematic reviews are unable to meet the necessary objectives or requirements of knowledge users.^[26,27] Munn *et al.* determined the

following six indications for conducting a scoping review: 1) determine the types of evidence that are available in a specific topic, 2) clarify main concepts and definitions in the specific topic, 3) clarify how studies are conducted on a specific issue, 4) determine the key characteristics or factors related to a specific concept, and 5) conducting a scoping review as a precursor to conducting a systematic review on a specific issue.^[27]

For this scoping review, we searched five scientific databases (PubMed, Scopus, Web of Science, ProQuest, and CINAHL), as well as Google Scholar for relevant studies using the following keywords: trauma, spinal cord injury, head injury, head trauma, collar, cervical collar, cervical immobilization, risk factors, prevalence, pressure injury, pressure ulcer, and bed sore. The Boolean operators (AND, and OR) were used to better search each database. The following is a sample of search strategies in the PubMed database: “pressure injury” [title/abstract] OR “pressure ulcer” [title/abstract] OR “bed sore” [title/abstract] AND “cervical collar” [title/abstract] OR “cervical” [title/abstract] OR “cervical immobilization” [title/abstract] AND “spinal cord injury” [title/abstract] OR “head injury” [title/abstract] OR “head trauma” [title/abstract].

Inclusion and exclusion

Concepts related to cervical collar and pressure injury, population groups as adults, older adults, and pediatric and only peer-reviewed studies were included in this study.

English/Persian articles were included in the study, and non-English articles were excluded [Figure 1]. Pre-print articles, editorials and commentary articles, review articles, electronic posters, conference proceedings, gray literature, and studies in which pressure injuries related to medical devices were not the primary reason for admission were excluded. Also, articles were excluded if their full-text version was unavailable and also if the focus of the article was an assessment or the evaluation of an instrument. The publication year of articles was limited from 1990 to 2022.

The search was performed independently by two researchers. Articles from the initial search were first recorded in special tables, and then, were reviewed and analyzed separately by two researchers. Title, abstract, and full-text screening were performed. In case of disagreement between the two researchers, a discussion was conducted or the opinion of the third researcher was obtained. After extraction, information from each article was entered into a special form categorized by year, country, study design, study population, the incidence of cervical collar-related pressure injury, risk factors for cervical collar-related pressure injury, and

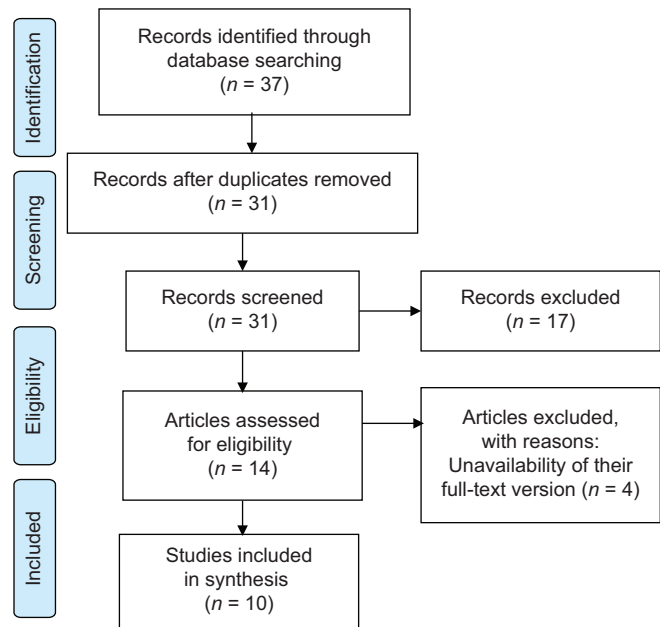


Figure 1: PRISMA flow chart

grades of pressure injury that were tested by the team before their use.

Results

The initial search showed 37 relevant articles. After the initial review, 23 articles were excluded due to duplication (6 articles), lack of information related to the aim of the study (17 articles), and unavailability of their full-text version (4 articles). Ultimately, 10 articles were included in the final analysis [Figure 1]. Table 1 lists the characteristics of these articles [Table 1].

Of the 10 articles, 6 were retrospective cohort studies, 3 were cross-sectional descriptive studies, and 1 was a case report study. Three studies were conducted in Spain, two studies in the Netherlands, and one study in the United States, Canada, Spain, and Iran. In terms of the study population, one study was conducted on pediatric patients, one was conducted on elderly patients, and eight were conducted on adults with head and spinal cord injuries.

In eight articles, the incidence of cervical collar-related pressure injury was reported. The reported incidence varied between 1.1% and 78.4%. The highest and lowest reported incidences were both related to studies conducted in the Netherlands. Only four studies (one case report study) assessed and reported the grades of pressure injury based on the National Pressure Ulcer Advisory Panel (NPUAP) grading system. In these studies, different grades of cervical collar-related pressure injuries were reported. However, most injuries were in grades 1 and 2. In eight articles, risk

Table 1: Article that entered in final review

Article Title	Country	Type of study	Sample Size	Incidence	Risk factors	Grades of pressure injury
1 Pressure injury development in critically ill patients with a cervical collar in situ: A retrospective longitudinal study (Wang <i>et al.</i> , 2020).	Australia	retrospective cohort study	906	0.7	duration of cervical collar use, hospitalization in intensive care units	grades 1 (<i>n</i> =2), 2 (<i>n</i> =2), 3 (2), and deep injury (<i>n</i> =2)
2 Pressure ulcers, indentation marks and pain from cervical spine immobilization with extrication collars and headblocks: An observational study (Ham <i>et al.</i> , 2016).	The Netherlands	Descriptive study	342	78.4	-	grades 1 (<i>n</i> =257) and 2 (<i>n</i> =10)
3 Cervical collar-related pressure ulcers in trauma patients in intensive care unit (Ham <i>et al.</i> , 2014).	The Netherlands	retrospective study	88	1.1	-	-
4 Factors predicting cervical collar-related decubitus ulceration in major trauma patients [published correction appears in Spine (Ackland <i>et al.</i> , 2007).	Australia	retrospective study	299	-	duration of cervical collar use, hospitalization in intensive care units, mechanical ventilation use	-
5 Cervical spine injuries and collar complications in severely injured paediatric trauma patients (Chan <i>et al.</i> , 2013).	Canada	retrospective study	365	5.2	duration of cervical collar use, hospitalization in intensive care units, low level of consciousness, longer hospital stay, and older age	-
6 Time in Collars and Collar-Related Complications in Older Patients (Nakanishi <i>et al.</i> , 2019).	Australia	retrospective study	1207	1.4	the use of cervical collar for more than 24 hours, male sex, hospitalization in intensive care units, low level of consciousness, and having underlying cardiorespiratory diseases	-
7 Pressure sores secondary to immobilization with cervical collar: a complication of acute cervical injury (Molano Alvarez <i>et al.</i> , 2004).	Australia	retrospective study	92	23.9	the severity of the disease, hospitalization in intensive care units, mechanical ventilation use	grades 1 (<i>n</i> =6), 2 (<i>n</i> =9) and 3 (<i>n</i> =7)
8 Insult after injury: pressure ulcers in trauma patients (Watts <i>et al.</i> , 1998).	The United States	descriptive	148	7.1	-	-
9 Pressure ulcer stage IV caused by cervical collar in patients with multiple trauma in intensive care unit (Tafti <i>et al.</i> , 2015).	Iran	case study	1	-	-	grades 4
10 An evaluation of the effects of semirigid cervical collars in patients with severe closed head injury (Chendrasekhar <i>et al.</i> , 1998).		retrospective study	52	38	duration of cervical collar use,	-

factors for cervical collar-related pressure injury were reported. The most common risk factors were duration of cervical collar use, hospitalization in intensive care units, low level of consciousness, and longer hospital stay.

Discussion

In previous studies, less attention has been paid to medical device-related pressure injuries in patients with head and spinal cord injuries. In this scoping review study, the studies about the prevalence and risk factors of cervical collar-related pressure injury in the head and spinal cord injuries were evaluated. Our findings showed that head and spinal cord injury patients, in whom a cervical collar is used, are at high risk of pressure injury. Results of the present review

also showed that longer duration of cervical collar use, hospitalization in intensive care units, and low level of consciousness were among the main risk factors for cervical collar-related pressure injury in this group of patients.

The incidence of cervical collar-related pressure injury was reported between 1.1% and 78.4%, which is significant. In addition to pain and discomfort, cervical collar-related pressure injury can lead some patients to have a higher risk of acquiring an infection than others.^[22] Given the importance of medical device-related pressure injuries, the NPUAP has identified several recommendations for the prevention of such injuries.^[28] Unfortunately, some of these measures are not useful for the prevention of cervical collar-related pressure injuries.

In 1986, the NPUAP was established to ensure ongoing pressure ulcer prevention, management, and research. It is an organization that works to develop guidelines and establish best practices for pressure ulcers. Through public policy development, education, and research, NPUAP has improved patient outcomes in the prevention and treatment of pressure ulcers.^[29] For instance, NPUAP has recommended that the skin of the areas where the medical devices are applied for the patient be evaluated for early signs of pressure injury shortly after removing the medical device.

Another recommendation is to move the device within short intervals. These recommendations are almost impossible in patients with trauma or suspected head and neck trauma. However, some of them are useful. For instance, NPUAP has recommended using of preventative dressings on the skin of the areas where the medical devices are applied. This measure is a more practical way to prevent medical device-related pressure injuries; however, their effectiveness in preventing cervical collar-related pressure injuries should be evaluated in future studies.

The first step in preventing pressure injury is to identify at-risk patients. In this regard, for regular pressure injuries, there are some pressure injury risk assessment tools, such as Braden, Waterloo, or Norton which can be used in addition to clinical judgment.^[30-34] However, it is not possible to use these tools to predict the risk of medical device-related pressure injury. It seems that it is necessary to develop similar tools to predict the risk of medical device-related pressure injury. Until then, identifying patients at risk for this type of injury will only be possible based on the clinical judgment of healthcare providers. In this study, the following factors were identified as the predictive factors for cervical collar-related pressure injury: duration of cervical collar use, hospitalization in intensive care units, low level of consciousness, longer hospital stay, older age, having underlying cardiorespiratory diseases, and the need for mechanical ventilation. These factors can be used to develop tools for predicting the risk of medical device-related pressure injury. In addition to this, identifying these factors helps healthcare providers make more accurate clinical judgments.

Our findings also showed that cervical collar-related pressure injuries can range from superficial (grade 1) to deep (grade 4) injuries. In this regard, in one study, it was reported that the injury was a deep tissue injury in which the skin remained intact, but the tissue beneath was damaged and necrotic. In areas where the collar has contact with the skin, including the occiput, chin,

mandible, and even upper regions of the chest, there is a small gap between the skin and the bone beneath it due to the low subcutaneous tissue. This causes cervical collar-related pressure injuries to quickly turn into grade 4 pressure injuries in which the bone beneath the area of injury can be seen. This issue should be considered by healthcare providers when caring for patients with a cervical collar and carefully assessing the injuries.

Nurses must be sensitive about skincare, nutrition, position changing, and training, and maintain the care with evidence-based about pressure ulcers.^[35]

The current study had remarkable limitations that should be considered when using the results. The methodology of data collection in the studies reviewed was mostly poor. Of the 10 articles, 1 was a case report study, and of 9 articles, 7 were retrospective studies. In this method, data is collected by referring to the records of discharged patients. This methodology faces remarkable limitations, the most important of which is the accuracy of data recorded in the records of discharged patients. In the studies reviewed, samples had also remarkable limitations. Of 10 articles, 8 studies were conducted on adults with head and neck trauma, 1 study was conducted on elderly patients, and 1 was conducted on elderly pediatric patients. Also, most of the articles did not evaluate the grades of pressure injuries, and none of them accurately assessed the areas where pressure injuries occur. Also, this study did not evaluate the quality of the evidence.

Another limitation of this study was the lack of high-level evidence such as randomized clinical trials; most of the findings were extracted from descriptive articles.

Conclusions

The current review study showed that a significant percentage of head and spinal cord injuries patients for whom cervical collar is used suffer from different grades of pressure injuries. Hence, healthcare providers should consider this issue when caring for this group of patients and take the necessary preventive measures in this regard. Also, several risk factors can increase the risk of cervical collar-related pressure injury in these patients. These risk factors can be used by nurses and other healthcare providers when caring for head and neck trauma patients to provide principled care to these patients. However, it should be noted that previous studies in this field had significant limitations, and thereby, it is strongly recommended to conduct further studies with a stronger methodology.

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Ethical considerations

This project was supported and approved by the ethics committee of Isfahan University of Medical Sciences with the project number IR.MUI.NUREMA.REC.1400.043 as part of the doctoral dissertation.

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Conflicts of interest

There are no conflicts of interest.

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