Patient Positioning: More Than Just "Turn Every 2h"

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For patients with neurological conditions, the routine nursing task of turning and repositioning requires special attention. Neuroscience nurses must select the optimal adjustments for the head of the bed and the best equipment and means of mobilization when caring for this complicated patient population. This article describes the careful balance of intervention and vigilance, hallmarks of neuroscience nursing care, in terms of patient positioning.

Key Words: nursing, positioning

Abbreviations Used: CSF, cerebrospinal fluid; EEG, electroencephalography; ICP, intracranial pressure

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Positioning patients with neurologic injury may seem like a routine nursing task. However, neuroscience nurses must consider many factors when they position patients. Nurses must optimize the neurologic function of patients with a brain injury while protecting them from the hazards associated with immobility. Patient positioning is not just a matter of "turn every 2h" or "head of bed 30 degrees at all times." Delicate balances in the circulation of blood, CSF, and cellular fluid as well as the dynamics of cerebral elastance and anatomical shift must be considered when patients with different types of brain injury are positioned. Important factors related to positioning also affect cognition, peripheral nerve function, joint mobility, pulmonary function, and general recovery from brain injury.

Position of Head of Bed

Once a cervical injury has been ruled out, several factors determine how the head of bed is positioned in patients with brain injuries. Research by physicians and nurses offers conflicting findings regarding the best position for the head of the bed for patients with neurologic injury. Positioning the head of the bed at 30 degrees is associated with lower ICP compared to a flat or lower elevation (Fig. 1).[6] Others advocate individualizing this decision for patients with large hemispheric strokes.[11] Elevating the head of the bed to 30 degrees decreases ICP, but it also decreases systolic arterial blood pressure. The effects of position change on other variables, including measures of cerebral perfusion pressure, jugular venous oxygen saturation, and velocity of cerebral blood flow, have also been studied.[6] Most

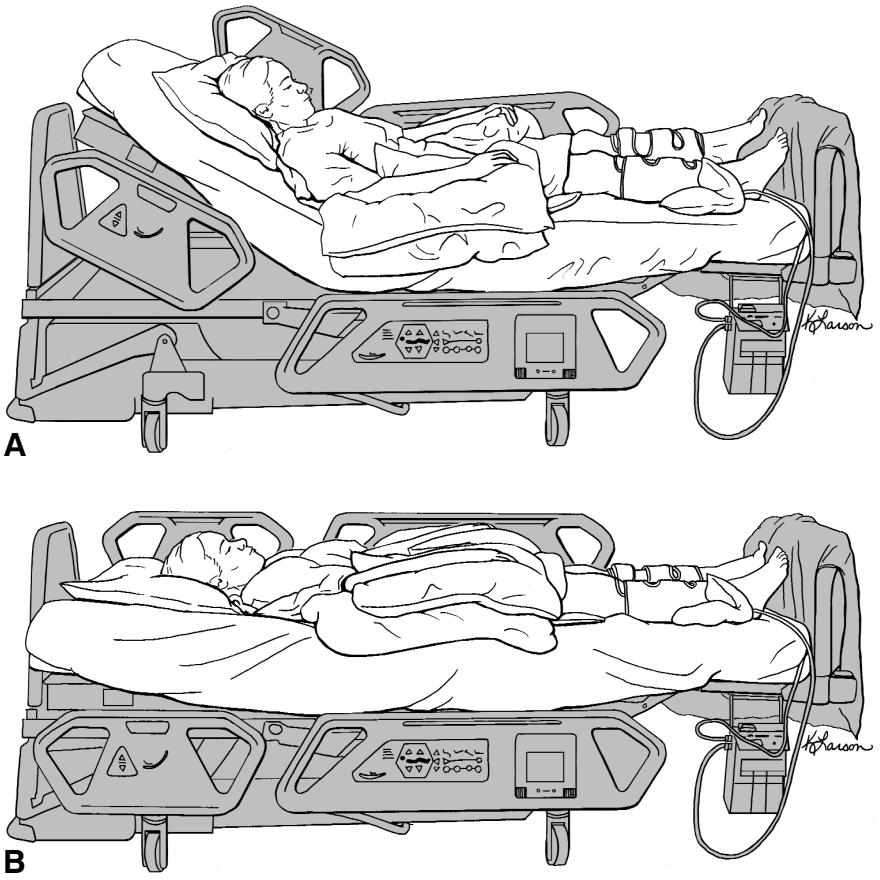

Figure 1. (*A*) The head of the bed is positioned at a 30-degree angle compared to a (*B*) horizontal or flat position.

researchers advocate raising the head of the bed to 30 degrees for patients with elevated ICP.[6] Researchers also advocate elevating the head of the bed to augment venous jugular return, arguing that the benefits outweigh the effects of lowered systolic arterial blood pressure.[8]

The position of the head of the bed may be individualized for patients with a subdural hematoma. Patients with chronic subdural hematomas tend to be from an older population and therefore have diminished cerebral elastance and some degree of brain atrophy. At our institution, such patients are managed with the head of bed flat after the subdural hematoma has been evacuated. This position prevents gravity from pulling the brain away from the dura. Theoretically, the flat position allows the CSF to float the brain in a more neutral position. Once the cerebral tissue has had a chance to expand to fill the void of the evacuated area, the head of the bed is elevated as tolerated (as determined by the physician's evaluation of a patient's routine computed tomography scans).

Patients with subarachnoid hemorrhages, cerebral contusions, epidural hematomas, and cerebral infarcts need the head of the bed positioned at 30 degrees. The head itself is positioned neutrally with the nose, chin, and sternum in alignment (Fig. 2). This position optimizes jugular venous drainage and decreases the chance of aspiration related to craniopharyngeal weakness. The head-up and neutral positions are maintained while the patient is alternated through the supine, right, and left side-lying positions. Pillows and rolled towels are placed strategically to prevent gravity or hyperactivity from placing paralyzed or overly active limbs, respectively, in a position that decreases venous return (Fig. 3).

For patients who have undergone transsphenoidal resection of a pituitary tumor, the head of bed is maintained at more than a 45-degree elevation to promote venous drainage of the head and brain. The drainage afforded by this position helps decrease swelling of the soft tissues of the face and helps to decrease fluid pressure on the surgical site. This elevation is instituted during the early postanesthesia phase while nurses team together to lift and position the patient in bed. It is maintained when the patient is alert and moving independently.

Determining the best position for patients with a CSF leak is another challenge. At our institution, the neuroscience nurses reason through the best management for each patient in collaboration with the physicians. In general, the head of the bed is elevated at all times for patients with rhinorrhea and otorrhea. Patients with leakage from spinal incisions are initially maintained with the head of the bed flat. If the patient has a lumbar drain inserted to manage the leak, stipulations for positioning may include gradually increased activity with titration of the height of the drainage chamber to achieve a desired volume of drainage.[10] Activity may be increased to include sitting in a chair, assisted ambulation, or both.

While the patient is standing and walking, the nurse closes the drain. When the patient is seated and comfortably stationary, the nurse levels and reopens the drain. During all repositioning, the nurse maintains the integrity of the drainage system. Pulling or tugging the drainage tube is avoided. The tube is observed carefully to avoid over- or underdrainage.

Severe Intracranial Hypertension

Patients with severe intracranial hypertension requiring treatment with a pentobarbital coma must be maintained in a neutral head position (Fig. 2) to optimize pulmonary function. Pentobarbital induces a comatose state, creates total flaccidity of the muscles, and interrupts basic reflexes. The patient's natural defenses against aspiration, atelec-

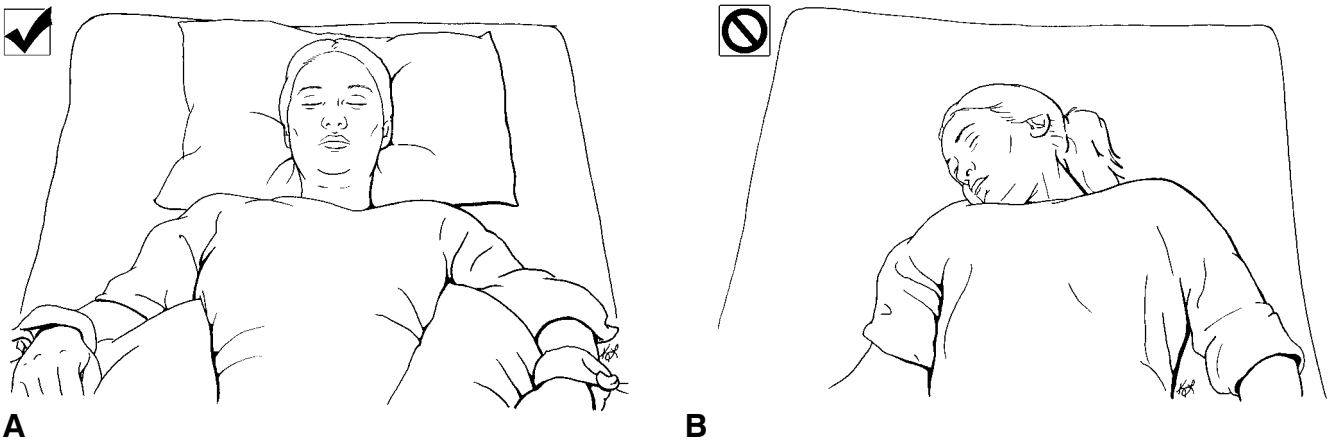

Figure 2. (*A*) Patient shown in optimal neutral alignment. (*B*) Misalignment can compromise a patient's jugular venous drainage and should be avoided.

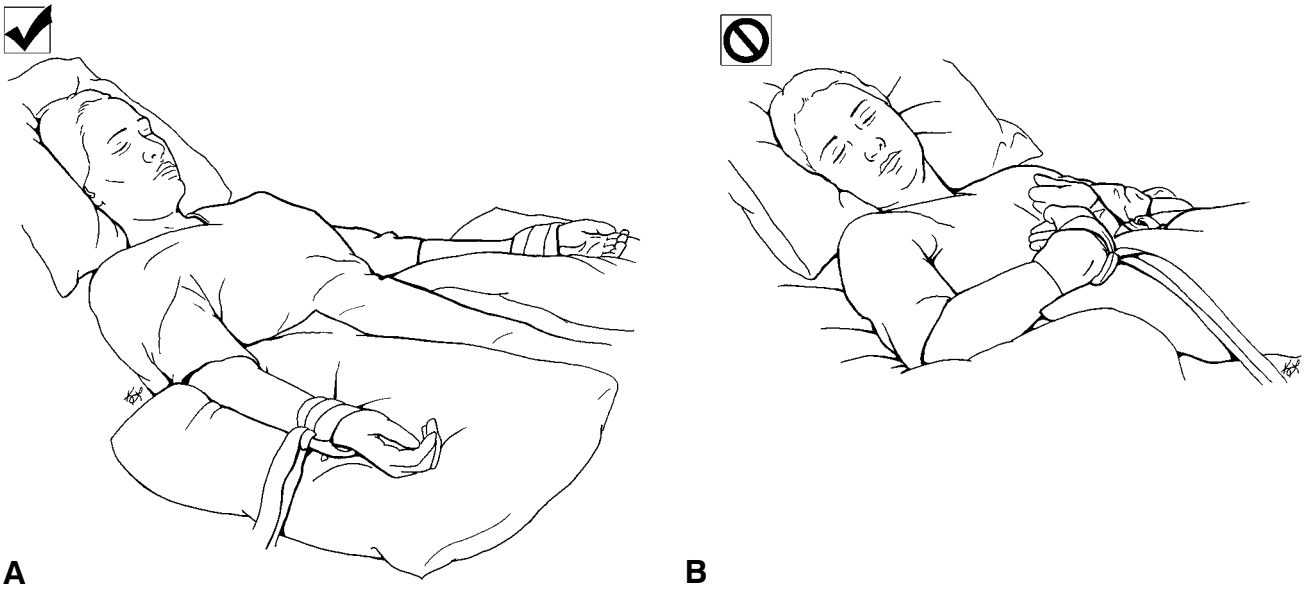

Figure 3. (*A*) Pillows positioned to elevate the arms in a supine position at the level of the heart to improve venous return and to minimize the risk of injury to the ulnar nerve. (*B*) Hyperflexed arms, which can impede venous return and decrease mobility, should be avoided.

tasis, and immobility are thereby paralyzed. Patients in this induced comatose state may experience profound increases in ICP merely from the stimulation associated with repositioning.

A solution to the complications associated with patient immobility has been the use of rotational beds. These beds use a motorized mechanism to turn patients from supine to side-lying positions at frequent intervals while eliminating the stimulation that can increase ICP. The head and limbs are maintained in controlled neutral positions via bolsters adjusted by the nurse according to the contour of an individual patient's habitus. The specialized beds provide the rotation necessary to mobilize pulmonary secretions and to promote pulmonary circulation.

Several types of rotational beds are available, and each has its own advantages and disadvantages. At our institution Roto Rest® beds (Kinetic Concepts Inc., San Antonio, TX) are preferred (Fig. 4). The firm bolsters on this bed achieve neutral alignment and continue to maintain the patient's position after hours of rotation. With this bed, the patient requires less frequent repositioning by the nurse.

The air pillow-styles of other rotational beds provide support and rotation but do not seem to adequately maintain neutrality of the axis formed by the head, chin, shoulder, and sternum, which optimizes jugular venous return. Air-style beds, however, relieve pressure and provide maximum degrees of rotation. Consequently, attention to skin integrity, especially over the bony prominences during activities of daily living, must be vigilant. Prolonged supine positioning

can cause a decubitus ulcer to form on the occiput. To maintain skin integrity, waffle air products can be used to cushion the occiput.

Even with the use of the best rotational bed, further intervention via manual positioning is sometimes needed to manage high ICP. Attention to subtle differences in a patient's physiologic responses to turning may show that a patient's ICP is higher when rotated to one side compared to the other. Patients may be intolerant to rotation as indicated by ICP sustained higher than 20 torr.

The issue of turning rests on the judgment of the critical care nurse who must balance the effects of various ICP interventions with the effects of rotation. Sometimes actions to facilitate pulmonary function alleviate factors that increase ICP. Close monitoring and adjustment of rotational bed settings so that a patient rotates to two possible directions, from supine to the side of best ICP, can allow continued mobilization of the patient in the presence of precarious intracranial hypertension.

Figure 4. Photograph of the RotoRest® bed used at our institution. The bed is shown rotated about 45 degrees to the left.

Avoidance of Peripheral Nerve Injury

Patients with various degrees of brain injury may or may not be able to sense or respond to the numbness, tingling, or pain associated with the onset of a peripheral nerve injury. Much of the research on iatrogenic peripheral nerve injuries is based on monitoring of postoperative complications. The most common peripheral nerve injury is ulnar neuropathy, which is associated with positioning for surgery. As a preventive measure at our institution, neurosurgical patients undergo monitoring during surgery to identify slowing of nerve conduction that can signal the possible onset of neuropathy. When indicated by the EEG technician, patients are repositioned during surgery to prevent potential injury.

In other inpatient care settings where patients are not monitored by EEG, the preventive measures advocated by the Association of Operating Room Nurses and The American Society of Anesthesiologists can still be considered.[1] These measures include avoiding extended pressure on the ulnar (Fig. 5) and peroneal nerves (Fig. 6). Patients are positioned with the extremities supported on pillows while the extremes of flexion and extension are avoided. To prevent irritation of the ulnar nerve, pressure is avoided in the area of the elbow and ulnar groove. To prevent irritation of the peroneal nerve, pressure on the head of the fibula must be avoided. Therefore, pillows are placed to avoid pressure behind the knee. The variability of peripheral nerve anatomy among patients requires nurses to develop individualized positioning changes for each patient. The nurse can adjust positioning by recognizing subtle movements of a semicomatose patient such as the tendency to move an extremity frequently or to grimace when a limb is repositioned. Simply alternating the position of an upper extremity from semiprone to supine can alleviate pressure on a susceptible ulnar nerve.[3]

Cardiovascular Function, Joint Mobility, and Motor Function

The comatose condition of patients recovering from serious brain injury can lead to weakened cardiovascular function, joint immobility, and decreased motor function. Neurologic injury can lead to spasticity and abnormal muscle tone, and these symptoms can be exacerbated by immobility. Bedrest in healthy subjects is associated with an increased heart rate and decreased cardiac vagal tone. In a study of five young healthy males subjected to 21 days of bedrest, an increase in their maximal heart rate was associated with a reduction in their maximal uptake of oxygen. The authors related the findings to decreased stroke volume and cardiac output.[4] Periods of immobility can lead to stiffness; to shortening of tendons and musculature surrounding the joints, especially in the scapula, hip, and lower back;[2] and to bone loss that can be slow to reverse with ther-

apy. Loss of joint mobility can impair rehabilitation. Patients with joint immobility must struggle to overcome both the immobility and paresis.

For these reasons, position changes have an important role in maintaining mobility for patients who will eventually regain motor function. Intermittently raising the head of the patient's bed to 45 to 90 degrees for short periods as soon as tolerated can help promote orthostatic responsiveness and combat some of the cardiovascular changes related to the supine position. Recognizing muscle hypertonicity and flaccidity before repositioning can help optimize intervention. Patients with hypertonic resistance to passive range of motion benefit from positioning that gently encourages relaxation of hypertonic muscles and increased range of motion of the affected joints. Some hemiplegic patients respond to positioning on the affected side so that the affected scapula is splinted in a position that decreases pain, allowing the surrounding muscles to relax. Positioning the upper extremities so that gravity can gradually open an affected elbow joint can enable a gentle increase in mobility of the upper extremity. Wrapping thin pillows to serve as splints around the elbow can help decrease hypertonicity and open the joint (Fig. 7).

Simple measures in turning brain-injured patients can prevent injury to joints and ensure smooth action of the muscles. When a patient is turned, first moving the patient's nose and chin into the direction of the turn often elicits a cooperative effort from the patient to reach into the turn (Fig. 8). By carefully placing a hand with fingers spread supportively behind the patient's scapula, the nurse can move the patient further into the sidelying position without injuring the scapula or shoulder joint.

Other measures are considered when a brain-injured patient is being repositioned. Periodically, patients slip down in bed and must be repositioned (Fig. 9). Incapacitated patients should be placed in a sitting position in bed or in a supportive chair at least twice a day. Consistently placing support under the affected

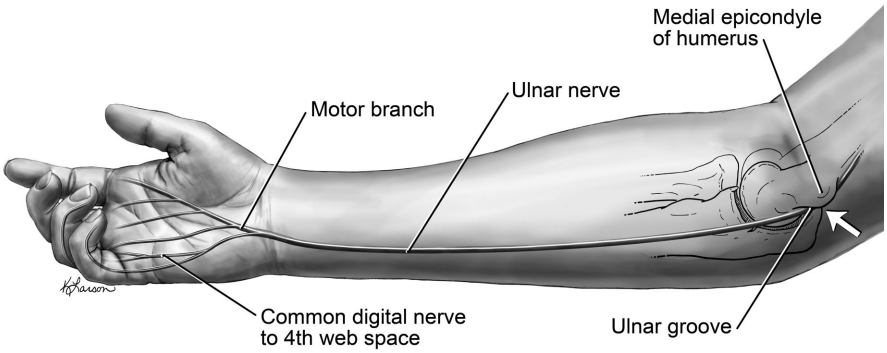

Figure 5. Illustration showing the course of the ulnar nerve and the site susceptible to pressure injury (*arrow*).

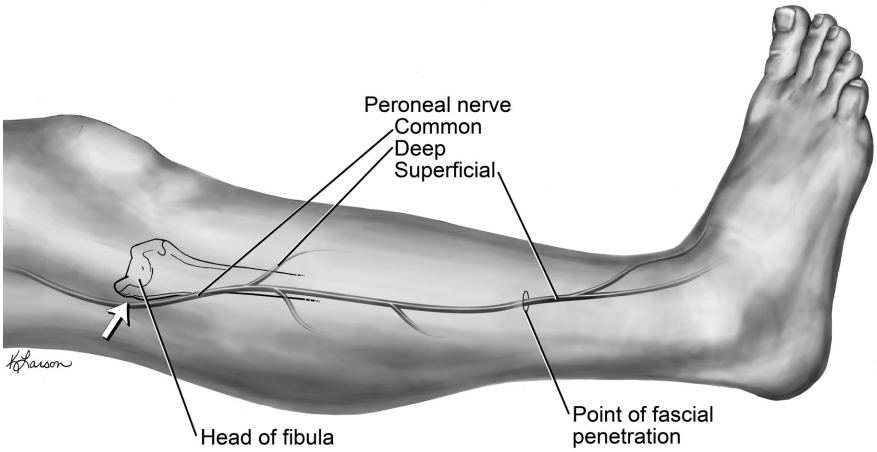

Figure 6. Illustration showing the course of the peroneal nerve in the lower leg and the site susceptible to pressure injury (*arrow*).

Figure 7. Patient with pillow splint around left elbow.

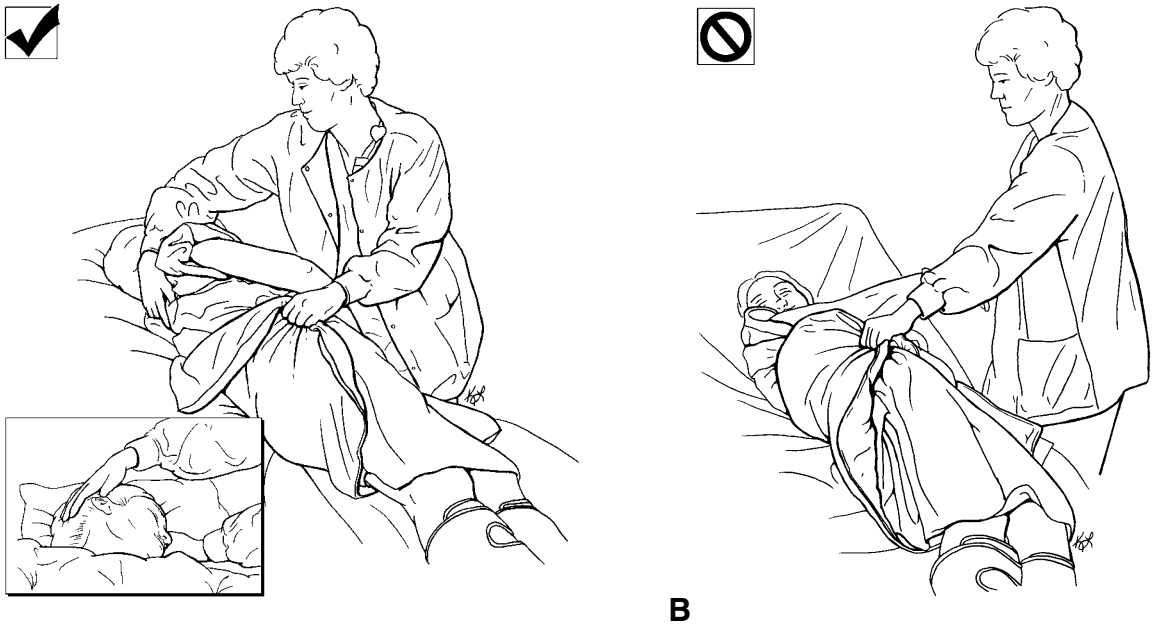

Figure 8. (*A*) Appropriate technique for turning incapacitated patients. The patient's head is first positioned in the direction of the turn (*inset*). (*B*) Inappropriate turning technique can lead to shoulder subluxation. When the head lags behind, the patient is more likely to resist the turn.

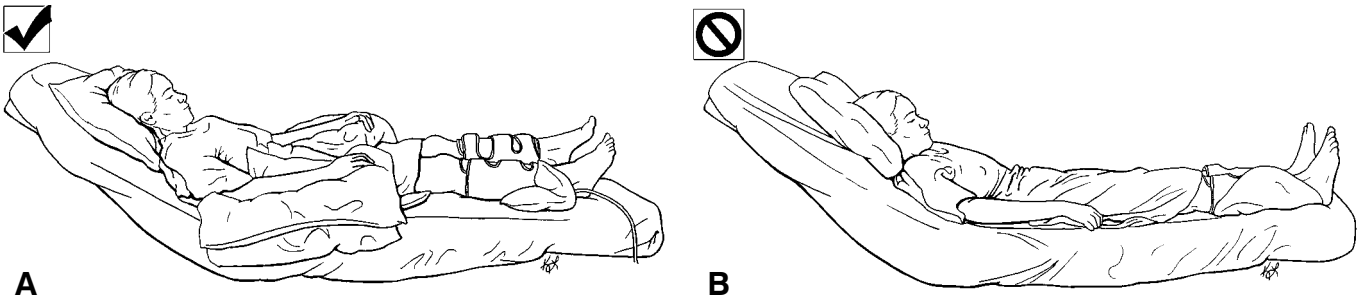

Figure 9. (*A*) When patient is positioned in bed appropriately, the hips are flexed to encourage normal expansion of the chest and abdomen. (*B*) When the patient's body slips toward the foot of the bed, flexion occurs higher than the hip and breathing is inhibited.

limb and behind both the affected and unaffected scapula can be enough to help the seated patient to maintain an aligned upright posture (Fig. 10). This position promotes chest expansion and decreases the likelihood of shoulder subluxation.

Early bilateral range of motion is another significant intervention provided by nurses and therapists. Range of motion performed bilaterally with the patient in a neutral supine position with the upper extremities moved in tandem may contribute to positive redevelopment of movement pathways (Fig. 11). Linking the reaching and rotating movements of the upper extremity during position changes strengthens core muscles and contributes to the balanced development of laterally weakened trunk muscles. This therapeutic maneuver can rehabilitate sitting balance and eventually can aid posture while standing. Proponents of this type of assisted activity stress the importance of avoiding overstimulation of compensatory unilateral hypertonic movements. Further increase in this kind of mobility is achieved by stimulation of normal body movements during activities of daily living and with activities that facilitate normal balance and muscle tone. Great patience and effort are needed to support patients in performing their own simple movements such as reaching toward a side rail or moving higher in bed.

Pulmonary Function

Managing patient position to optimize pulmonary function is a common challenge for neuroscience nurses, and current research supports the nurses' efforts in this area. Studies have shown that maintaining the head of the bed at a minimum of 30 degrees is independently associated with fewer occurrences of ventilator-acquired pneumonia.[9,12] Studies also support intermittently positioning patients in the prone position to promote

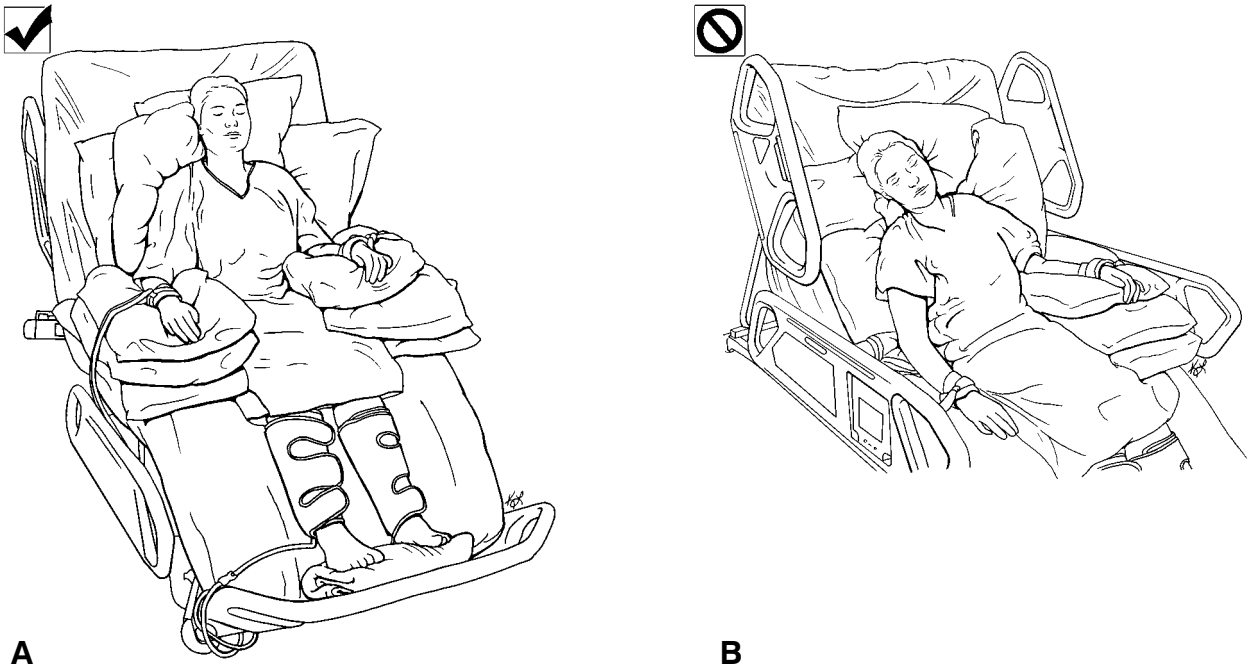

Figure 10. (*A*) Appropriate positioning of a right hemiplegic patient. The right side of the head, both scapulae, and both arms are supported to maintain an aligned upright position. (*B*) When the patient is positioned inappropriately and the head and limb are unsupported, the patient lists to the right.

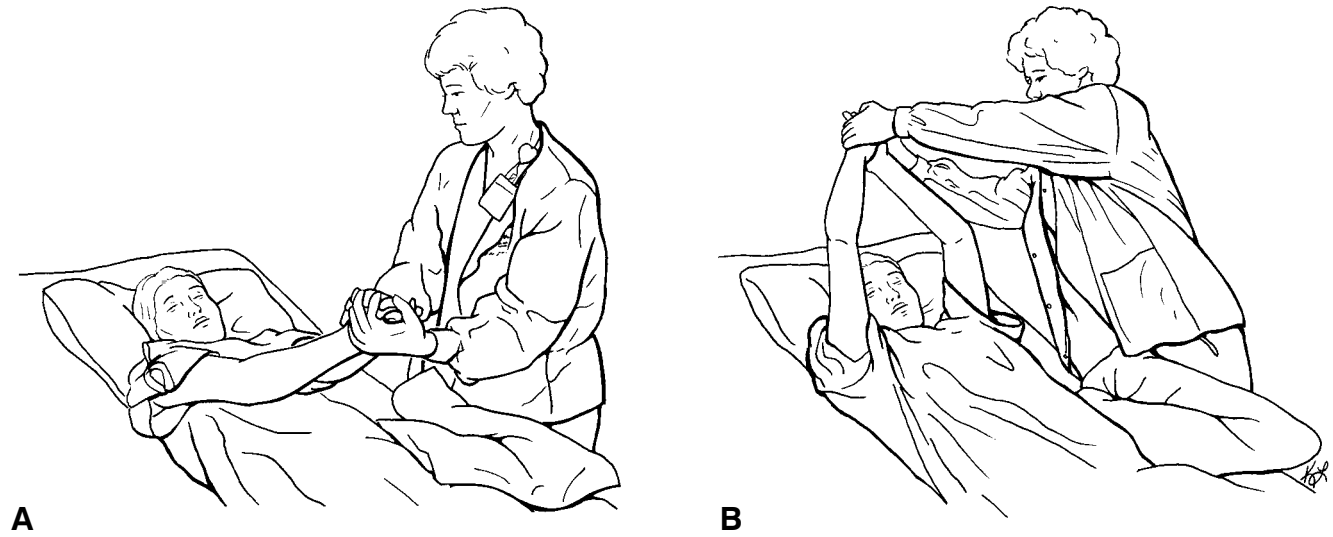

Figure 11. Sequence of range-of-motion exercises. The nurse moves the patient's upper extremities in tandem.

recovery from severe respiratory complications.[5] The nurse must balance the positive effect of positioning against the patient's ability to tolerate the position. As stated earlier, small changes in position can have large effects on ICP. Anticipating how rotation will affect the position of invasive lines such as the endotracheal tube, ventilator tubing, feeding tube, and central line is important. Overstimulation of a cough or gag reflex by movement of the lines can cause precarious increases in lung pressure.

Adding a semiprone position to a turning regimen may be beneficial for patients unable to tolerate a fully prone position. The semi-prone position is similar to the side-lying position but includes more rotation (Fig. 12). The patient's elevated shoulder, arm, hip, and lower limb are rotated beyond midline and supported on pillows. This position is thought to help increase circulation within the lung fields and to allow some

movement of static secretions, which, in turn, may open collapsed alveoli. Although the patient is not fully prone in this position, the patient's airway is still less visible to the nurse. Consequently, it is crucial to check the airway to make sure that it remains patent.

Figure 12. Appropriate placement of patient in the semi-prone position. Because the patient's airway is partially obscured, the nurse must be vigilant to ensure adequate respiration.

Cognition

Positioning procedures can have positive effects on the cognition of patients who are lethargic or even semicomatose. Such patients may have their eyes open only for brief periods. When reclined to 30 degrees or less, as is typical, their view is mostly of the ceiling and upper parts of walls (Fig. 13A). Caregivers are predominantly seen leaning over side rails straining to place themselves in the patient's line of vision. If the patient's response to position changes (i.e., ICP, cerebral perfusion pressure, systolic arterial blood pressure) begins to stabilize, repositioning the patient to an upright 45- to 90-degree angle provides a relatively normal view (Fig. 13B). Caregivers in the patient's line of vision no longer need to strain to see the patient. They can stand or sit comfortably and see the patient "eye to eye." This perspective may help patients to comprehend their environment, to see their family in ordinary stance, and thereby to improve their interaction with their caregivers.[7]

Figure 13. (*A*) Typical view from patient's perspective when the head of the bed is positioned at 30 degrees. (*B*) View from patient's perspective when positioned at a 90-degree angle.

Conclusion

Neuroscience nurses must balance the basic standards of nursing practice with evidence-based and aesthetic aspects of caregiving. The benefits of regular changes in a patient's position must be weighed against the risk of fluctuations in cerebral blood flow, cerebral perfusion pressure, ICP, and systolic arterial blood pressure and the myriad issues associated with immobility. When these complex issues are artfully balanced by neuroscience nurses, significant complications can be avoided and lifetime outcomes for patients can be improved.

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