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## POSITIONNEMENT SÉCURITAIRE POUR LES PATIENTS EN NEUROCHIRURGIE

### Auteurs :

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### RÉSUMÉ :

Le positionnement d'un patient lors d'une intervention chirurgicale joue un rôle important dans les soins périopératoires, rôle méritant d'être souligné. La combinaison des facteurs du temps, pression mécanique et immobilité augmente le risque de lésions des tissus.

L'objectif des activités de positionnement périopératoire est d'équilibrer les besoins d'accès chirurgical et la prévention de toute blessure liée au positionnement, tout en maintenant l'alignement normal du corps, c'est-à-dire sans flexion, extension ou rotation excessives.

Suivant les principes généraux de positionnement, certaines préoccupations quant au raisonnement chirurgical sont présentées pour chacune des positions neurologiques les plus courantes (sur le dos, genoux à la poitrine, sur le ventre, latéral, banc, assis, par exemple).

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Les normes de l'AIISOC relatives à cet article se trouvent dans les *Normes de pratique recommandées, lignes directrices et énoncés de position pour la pratique en soins infirmiers périopératoires (8<sup>e</sup> édition)* de l'Association des infirmières et infirmiers de salle d'opération du Canada (AIISOC) (2007), module 3, pages 19 à 22, norme 6.

## SAFE POSITIONING FOR NEUROSURGICAL PATIENTS

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### ABSTRACT:

**Positioning the patient** for surgery is an important part of perioperative nursing care that should not be underemphasized. The combined factors of time, mechanical pressure, and immobility increase the risk of tissue damage.

**The objectives** of perioperative positioning activities are to balance optimal surgical exposure with the prevention of any injury related to position and to maintain normal body alignment without excess flexion, extension, or rotation.

After providing general principles of positioning, specific considerations with surgical rationale are presented for each of the commonly used neurosurgical positions (eg, supine, knee-chest, prone, lateral, park-bench, sitting).

Positioning the patient for surgery is an important part of perioperative nursing care. Although it can become routine, its importance should not be underemphasized because the combined factors of time, mechanical pressure, and immobility increase the patient's risk of tissue damage.<sup>1</sup> The neurosurgical perioperative team faces additional challenges related to positioning because of the potential for complications during prolonged and complex neurosurgical procedures.

Perioperative neurosurgical nurses are responsible for the safety of their patients, and safe positioning ranks high on their list of priorities. Like all perioperative nurses, the neurosurgical nurses at Montreal Neurological Hospital, Montréal, Quebec, Canada, have applied principles of anatomy and physiology to positioning surgical patients. In many circumstances, the OR team must use creativity to protect their patient from mechanical injury and maintain cardiovascular, pulmonary, and other physiological functions.

Technological advances in specialty positioning devices also have contributed to improved patient outcomes.<sup>1,2</sup> This article discusses general principles of positioning as well as the most frequently used positions for neurosurgery—supine, knee-chest, prone, lateral, park-bench, and sitting.

### GENERAL PRINCIPLES OF POSITIONING

Safely positioning the patient must be a team effort; each member of the surgical team plays a significant role and shares the responsibility for establishing and maintaining the correct patient position. Each member of the team brings his or her knowledge of anatomy and physiology as well as experience in using various positioning aids and accessories to the safe positioning of patients.

The primary objective of these activities is to balance optimal surgical exposure with the prevention of any injury related to positioning. At Montreal Neurological Hospital, the perioperative team involved with positioning consists of the circulating nurse, neurosurgeon, anesthesia care provider, and patient attendant. Throughout the intraoperative period, it is the circulating nurse's responsibility to preserve the patient's dignity, safety, and physical well-being. One of the circulating nurse's most important responsibilities is performing the preoperative assessment of each patient in regard to positioning risk factors and documenting any preexisting conditions.

**POSITIONING ACTIVITIES.** The circulating nurse is responsible for coordinating positioning activities and is an active participant in safely positioning the patient. Furthermore, the circulating nurse ensures that a sufficient number of personnel are available to position the patient safely and effectively. The neurosurgeon determines optimal exposure of the surgical site, the anesthesia care provider ensures physiological stability, and the patient attendant prepares and installs positioning devices and equipment.

After the neurosurgeon determines appropriate exposure of the surgical site but before the patient is transferred to the OR bed, the circulating nurse ensures that all positioning devices and equipment are readily available, in proper working order, and clean. Positioning devices should be able to perform the following functions effectively:

- absorb compressive forces,
- prevent uneven and potentially excessive pressure distribution,
- prevent excessive stretching or compression, and
- allow chest expansion for proper ventilation and gas exchanges.

Normal body alignment must be maintained without excess flexion, extension, or rotation. For example, extreme rotation of the head can cause pressure on the carotid sinus and induce hypotension and arrhythmias or restrict venous outflow leading to congestion.<sup>3</sup> The nurse and

anesthesia care provider work cooperatively to ensure that direct pressure on the patient's eyes is avoided to minimize the risk of central retinal artery occlusion and other ocular damage (eg, corneal abrasion). If possible, the patient is positioned so that his or her head is level with or higher than the heart and is maintained in a neutral forward position without significant neck flexion, extension, lateral flexion, or rotation.<sup>4</sup>

The anesthesia care provider requires access to IV lines and monitoring devices throughout the procedure to monitor and control the patient's physiological functions. The anesthesia care provider ensures that there is adequate room for chest and abdominal expansion to protect the patient's respiratory functions. The circulating nurse applies thromboembolic disease (TED) stocking or intermittent pneumatic sequential compression devices (SCDs) to reduce blood pooling in the legs; the nurse also applies SCDs if the patient is undergoing a surgical procedure with general anesthesia that will last longer than 30 minutes.<sup>5</sup>

### **MAINTAINING NORMOTHERMIA.**

Maintaining normothermia in relation to positioning is important.<sup>6</sup> The fall in core temperature that occurs after induction of anesthesia leads to a peripheral vasoconstriction, which can result in peripheral hypo-perfusion and cell hypoxia.<sup>6</sup> The tissue damaging effects of pressure are more likely to occur after a decrease in oxygen delivery.<sup>6</sup> The circulating nurse ensures that normothermia is maintained by

- minimizing exposure of the patient's skin,
- using a temperature-regulating blanket or forced-air warming device, and
- controlling the OR ambient temperature.<sup>4,7</sup>

These actions also increase patient comfort at the time of induction.

### **PREVENTING PRESSURE ULCERS.**

The intraoperative incidence of pressure ulcers is directly related to the length of surgery.<sup>4,7</sup> Most patients can tolerate pressure for brief periods. Tissue hypoperfusion, ischemia, and necrosis can occur, however, if the pressure continues for prolonged periods of time. Certain conditions make patients more vulnerable to injury, such as

- age (ie, neonates, adults older than 70);

- cardiac disorders;
- cancer;
- diabetes;
- poor preoperative nutritional status;
- preoperative physical or immobility limitations (eg, decreased range of motion);
- preexisting pressure ulcers;
- size (eg, small in stature, thin, morbidly obese);
- smoking; and
- vascular disease.<sup>1,4</sup>

Approximately 80% of all pressure ulcers occur in one of four anatomical locations: sacrum, ischium, trochanter, and heel.<sup>2</sup> When subcutaneous blood flow is compromised, tissue anoxia can occur, which contributes to the development of pressure ulcers.<sup>7</sup> Muscle and tissue damage can occur when the skin and subcutaneous layers are torn. Lifting and moving the patient, instead of simply pulling, prevents shearing injuries.

An effective tool that circulating nurses can use to prevent pressure ulcers is a viscoelastic (ie, gel) pad placed between the patient and any hard support surface.<sup>4</sup> This redistributes mechanical pressure, such as that experienced by a bony prominence. The circulating nurse ensures that all body pressure points are padded to protect the patient from pressure ulcers and injuries to nerves and muscles.

### **PREVENTING BURNS.**

The surgical team must prevent unintentional burns related to electrosurgical use. The circulating nurse ensures that the patient's skin does not contact any metal surfaces that can act as electrical ground.

### **PREVENTING HYPOTENSION.**

The surgical team must perform any significant positional changes slowly to allow for hemodynamic compensation and to prevent hypotension. After any movement of the patient, repositioning, or change of positional devices, the nurse should reassess the patient's overall position for proper body alignment and recheck all potential pressure points.

**PLAN OF CARE.** Using information he or she obtained during the preoperative assessment

## NEUROPOSITIONING (cont.)

regarding the patient's physical limitations; range of motion; skin condition; and areas most prone to injury, like bony prominences, the circulating nurse develops an individualized patient plan of care to prevent nerve injury or pressure necrosis.<sup>4,7</sup> This plan highlights the nursing actions that must be implemented to prevent injury while maintaining optimal surgical access, patient comfort, and physiologic support.<sup>7</sup> Perioperative team members should continuously monitor the patient's position during the procedure to proactively identify positioning problems that may arise.

**POSTOPERATIVE ASSESSMENT.** Before transferring the patient to the postanesthesia care unit (PACU), the circulating nurse assesses the condition of the patient's skin and tissue integrity, especially areas subjected to constant pressure because of patient positioning.<sup>7</sup> It is essential that the circulating nurse evaluates and documents the patient's skin for signs of breakdown, including color change, swelling, and redness in comparison to the nurse's preoperative assessment of the patient.<sup>4</sup> The nurse also should evaluate limb function to rule out nerve damage. The circulating nurse then must clearly document all observations.<sup>8</sup> The circulating nurse documents any changes in the patient's skin integrity on the OR record and reports it to PACU nurse during the hand-off report. If an incident is noted, the circulating nurse initiates an incident report and ensures that the appropriate clinician performs a follow-up with the patient. The recovering nurse receiving the patient completes the postoperative neurological assessment in the PACU or intensive care unit, comparing it with the preoperative assessment.

### SUPINE POSITION

The supine position is used often in neurosurgery because it offers good exposure to the:

- anterior and middle fossae of the cranium,
- anterior aspect of the neck,
- face, and
- anterior medial and lateral aspects of the upper and lower extremities.<sup>7</sup>

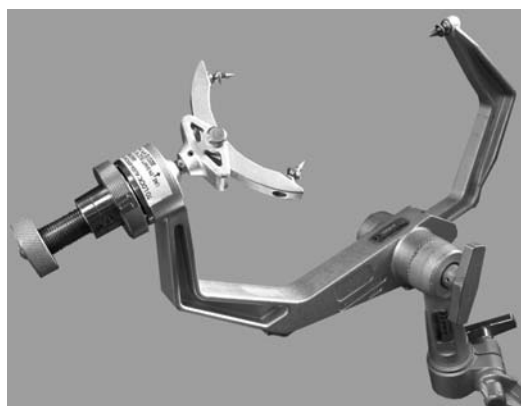
The supine position allows the patient to move onto the OR bed under his or her own power if

capable of doing so, which allows most of the positioning to be accomplished before induction of anesthesia. The patient is able to verbalize his or her comfort level and adjustments can be made as necessary.

Before bringing the patient into the OR, the patient attendant places a gel overlay on the OR bed. The patient moves, or is moved, to the OR bed and lies on his or her back with the arms either resting on an arm board or maintained at the side supported by an arm protector. The nurse places a pillow under the back of the patient's knees to relieve pressure on the lower back.<sup>4,6</sup> Flexing the hips and knees by placing a standard-size pillow behind the knees helps keep the patient in an anatomically correct position while protecting the common peroneal and tibial nerves. The common peroneal and tibial nerves behind the knee may be injured if the knee support is placed directly in the popliteal space.<sup>7,9</sup>

The nurse ensures that the patient's heels are elevated off the underlying surface; if this is not possible (eg, because of the patient's size), the nurse places a gel or foam pad under the patient's heels. The nurse places the safety belt two inches above the knees.<sup>7</sup> A belt positioned directly over the knees can compress the common peroneal nerve against the head of the fibula.<sup>7</sup> The belt must be properly fitted on the patient's thighs to make sure the vessels in the lower extremities are not occluded. The nurse checks the patient's feet (eg, color, capillary refill time, pulses compared to

Figure 1



By: Benoit Ulrich

Neurosurgical three-point headrest stabilizing device.

## NEUROPOSITIONING (cont.)

Figure 2



By: Benoit Ulrich

Neurosurgical horseshoe headrest stabilizing device.

baseline values) after securing the safety belt to ensure adequate perfusion.<sup>7</sup>

After induction of anesthesia, a neurosurgical stabilizing device is used to provide fixation of the skull, taking great care to ensure proper alignment of the head and neck. Depending on the procedure, the surgeon may choose to use a neurosurgical three-point headrest (Figure 1) which provides rigid fixation, or the neurosurgical horseshoe headrest (Figure 2), which prevents pressure on the occiput. Pressure alopecia has been reported from pressure on the occiput, especially in the presence of hypothermia during prolonged procedures.<sup>6</sup>

The patient attendant holds the patient's head and the anesthesia care provider ensures that the endotracheal tube is secure from the time the OR bed headrest is removed until the neurosurgeon secures the skull clamps or places the patient's head on the horseshoe device. The anesthesia care provider lubricates the patient's eyes and tapes them closed to prevent conjunctival drying, corneal abrasion, or conjunctivitis from antiseptic solutions. The anesthesia care provider ensures that direct pressure on or contact with the globe of the eye is avoided by using an attachment placed over the patient's face to keep the drapes off the eyes.

The circulating nurse extends the patient's arm with the IV line at less than 90 degrees from the long axis of the procedure bed to prevent a

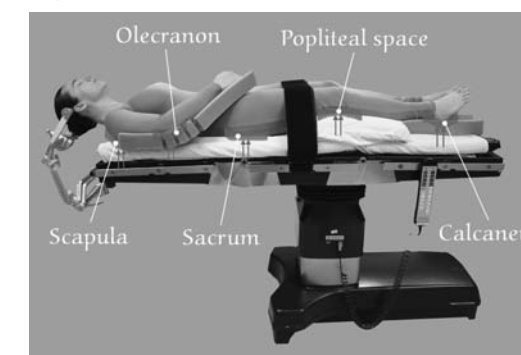
stretching injury of the brachial plexus and a compression or occlusion injury of the subclavian and axillary arteries.<sup>4,7</sup> The nurse places the patient's other arm alongside the body with the elbows padded and the palms facing in toward the patient's body. He or she encloses the patient's hands within a foam protector. The nurse places the arm against the body and if necessary uses a draw sheet that extends above the elbows to tuck between the patient and OR bed mattress. He or she then ensures that the patient's heels are elevated off the underlying surface; if this is not possible, the nurse places gel/foam pads under the patient's ankles and heels to prevent pressure ulcers.

When positioning has been completed, the circulating nurse assesses and documents that the patient's occiput, scapula, olecranon, elbows, popliteal space, and heels are free of pressure and well protected (Figure 3).<sup>6,7,9</sup> Perioperative team members should continuously monitor the patient's position to proactively identify potential problems. The nurse assesses the patient's skin and the tissue integrity of these pressure points postoperatively and documents any abnormalities.<sup>7,8</sup>

### KNEE-CHEST POSITION

Neurosurgeons often prefer the knee-chest position for lumbar and thoracic laminectomies and discectomies. This position provides good exposure of the vertebral laminae and foramina

Figure 3



By: Benoit Ulrich

Patient in the supine position with vulnerable areas identified and protected.

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## NEUROPOSITIONING (cont.)

Figure 4



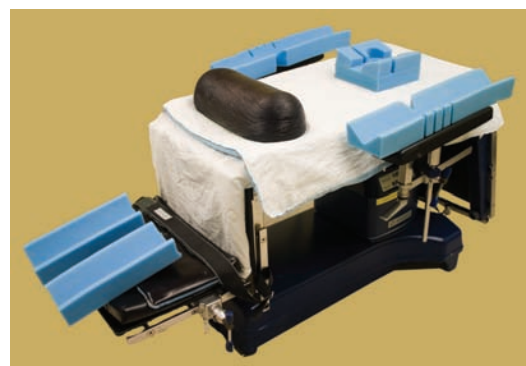
By: Benoit Ulrich

Flat bottom gel bolsters.

in the posterior aspect of the spine and allows the patient's abdomen to remain free of mechanical pressure, easing ventilation with minimal cardiovascular compromise.<sup>6</sup> Other advantages of this position include reduced pressure on the abdominal viscera and vena cava and decreased bleeding because of the collapse of epidural veins.<sup>10</sup>

Before induction of anesthesia, the circulating nurse checks all equipment and positioning devices (eg, head positioning device, a flat-bottom gel bolster) to ensure that all are immediately available and are appropriate for the patient's size (Figures 4 and 5). Induction of anesthesia is performed while the patient is in the supine position on the OR stretcher. The

Figure 5



By: Benoit Ulrich

OR bed and positioning aids prepared for a knee-chest position.

anesthesia care provider lubricates the patient's eyes and tapes them closed. The anesthesia care provider will assess the patient's eyes regularly while the patient is in the knee-chest position.

At least four people are required to safely turn and position the patient.<sup>4</sup> To prevent injury to the patient and personnel, all team members should know the correct sequence to follow.<sup>6</sup> The anesthesia care provider positions the patient's head, ensuring that the neck and spine remain in alignment and the patient's spine is stable. Although ocular injury has been reported with and without the use of a neurosurgical three-point headrest, use of the neurosurgical horseshoe headrest may increase the risk of ocular compression and perioperative central retinal artery occlusion.<sup>4</sup> The circulating nurse helps the anesthesia care provider ensure that the patient's eyes and dependent ear, if the head is turned, are free from pressure.

One team member places a flat-bottom gel bolster horizontally above or below the chest to leave the abdomen free from compression (Figure 6). The circulating nurse checks the breasts of female patients to avoid excessive pressure. If the patient's breasts are large, the nurse places the flat-bottom gel bolster above the breasts to support the chest and prevent neck compression by breast tissue; the bolster is placed below the breasts if the breasts are small.

A team member places the patient's arms on the arm boards, ensuring that no muscles are under tension and the forearm, wrist, and hand are aligned in a neutral position and then places pads under the patient's arms to protect the ulnar and radial nerves from excessive pressure. The patient's arms must not be brought over his or her head because this would create pressure on the axillary neurovascular complex by the humeral head.<sup>6</sup> To further avoid compression or stretching of the brachial plexus, the nurse places padding under the patient's axillae. After the arms are positioned, the anesthesia care provider checks the pulses at both wrists.<sup>6,7</sup>

A sitting bracket with lateral supports provides support for the lower body and stabilizes the

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Figure 6



By: Benoit Ulrich

Patient in the knee-chest position.

hips and buttocks. A significant danger of the knee-chest position is impaired perfusion distal to the knees as a result of vascular kinking in the popliteal space.<sup>8</sup> The nurse ensures that excessive hip or knee flexion is avoided and checks the pedal pulse of both feet to assess for adequate perfusion. A team member places a gel pad under the knees and foam pads under the feet, ensuring that the feet flex pointing downward. For male patients, a team member verifies that the patient's genitalia are free from torsion and are not compressed between the pelvis and the OR bed.<sup>4,7</sup> The circulating nurse places a safety belt behind the knees, above the popliteal space, making sure that the belt does not cause compression on the posterior thighs.

When positioning has been accomplished, the nurse makes sure that the following pressure points are well protected: eyes, ears, anterior rib cage, women's breasts, elbows, men's genitalia, posterior thighs, knees, ankle, and toes.<sup>6,7,11</sup> Postoperatively, after the patient is transferred to a stretcher, the nurse assesses and documents the patient's skin and tissue for integrity with special attention to the knees and ankles because of the extreme pressure created by this position.<sup>7,8</sup>

**Steps for Placing a Patient in the Knee-Chest Position**

When the patient is ready to be transferred, the circulating nurse ensures that the OR stretcher is locked against the locked OR bed. Four people are needed for a safe transfer. Person A,

usually the anesthesia care provider, is responsible for the patient's head. Person B, usually the nurse, is at the feet. Persons C and D, usually the neurosurgeon and patient attendant, are positioned one on each free side of the OR bed and OR stretcher and are responsible for supporting the patient's body.

- Person A, at the head, is in charge of the count. At the count of "3", persons C and D lift and move the patient to the edge of the stretcher without dragging the patient to prevent shearing forces while simultaneously, person A supports the patient's head and person B supports the patient's legs.
- Before turning the patient, persons C and D ensure that the patient's arms are at his or her sides.
- Person A again counts to "3" and all four team members roll the patient onto his or her side using the draw sheet and slowly bring the patient face down on the OR bed.
- Simultaneously, person B allows the patient's legs to flex at the knees and come to rest on the base segment of the OR bed, below the level of the chest.
- Person A positions the patient's face on a padded headrest.
- Person C moves the OR stretcher out of the way and puts the buttock support in place.
- Persons B and D bring the patient's arms forward and hold the patient's arms in place while person C puts the arms supports in place.
- While persons A, B, and D bring the patient's torso, person C places a flat-bottom gel bolster horizontally above or below the chest to leave the abdomen free from compression.
- Persons C and D verify that the knees are on a gel pad and place padding under the patient's feet, ensuring that the feet flex pointing downward and the toes do not rest against anything.
- Person D places the safety belt behind the patient's knees, above the popliteal space, making sure that the belt does not cause compression on the posterior thighs.
- After positioning is complete, persons A, B and D assess the vulnerable pressure

points: eyes, ears, anterior rib cage women's breasts, elbows, men's genitalia, posterior thighs, knees, ankles, and toes.

**PRONE POSITION**

The prone position provides good exposure of the dorsal surface of the body. It allows access to the posterior head, neck, and spinal column.<sup>6</sup> The prone position is used for spinal procedures, including cervical, thoracic and lumbar laminectomies and fusion, as well as parietal, occipital, and suboccipital craniotomies.

Before induction of anesthesia, the circulating nurse checks all equipment and positioning devices (eg, head positioning device, a flat-bottom gel bolster, extra gel and foam pads) to ensure that all are immediately available on a separate cart and are appropriate for the patient's size. As with the knee-chest position, the patient is anesthetized on the stretcher in

the supine position. The circulating nurse ensures that the OR bed is ready with a gel pad overlaying two parallel chest supports, a square gel pad in place to support the knees, and two pillows to support the lower legs (Figure 7).

After induction of anesthesia, the anesthesia care provider lubricates the patient's eyes and tapes them closed. The anesthesia care provider assesses the patient's eyes regularly while the patient remains in the prone position. Depending on the anticipated length of surgery, the circulating nurse places SCDs on the patient's legs. The same steps as described for the knee-chest position are followed, with only minor modifications to keep the legs extended.

Taking into account the length and the type of surgery as well as the patient's facial anatomy, the surgeon may choose to position the patient's head on a neurosurgical three-point or horse-

*Continued on Page 26*

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## NEUROPOSITIONING (cont.)

shoe headrest, foam square, or donut-shaped gel support, ensuring protection of the patient's forehead, eyes, and chin. Use of the neurosurgical headrest provides a clear path for the endotracheal tube and allows a full view of the patient's face. It also keeps the ears free from excessive pressure<sup>6</sup> but may increase the risk of ocular compression and perioperative central retinal artery occlusion.<sup>4</sup> Excessive pressure on the eyes could lead to postoperative blindness, so the anesthesia care provider positions the dependent eye and ear, if the head is turned, to ensure that they are free from pressure.<sup>12,13,14</sup>

The two longitudinal chest supports extend from the clavicle to the iliac crest, leaving the abdomen relatively free, reducing abdominal compression, minimizing vascular congestion, and allowing maximum expansion of the diaphragm and lungs during ventilation.<sup>4,7,11</sup> The circulating nurse places his or her hand between the chest supports and the OR bed to ensure that the abdomen is not being compressed. The gel overlay on top of the

Figure 7



Overhead view of the OR bed set-up for prone position.

Figure 8



By: Benoit Ulrich

Patient in the prone position.

bolsters protects the lateral femoral cutaneous nerve that is vulnerable to injury by compression on the thigh distal to the inguinal ligament.<sup>6</sup> The overlay also reduces the incidence of pressure ulcers on the chest and iliac crests, but it must not be allowed to reduce the area for the abdomen between the bolsters. The circulating nurse ensures that the breasts of female patients are allowed to rest between the bolsters to avoid significant compression of the breasts. The nurse also checks male patients' genitalia to prevent compression.

Team members slightly flex the patient's knees to prevent knee pain and protect them with pads (Figure 8). The nurse supports the patient's lower legs with pillows and the anesthesia care provider flexes the OR bed at the foot to prevent inguinal nerve injury from excessive hip flexion.<sup>6,7</sup> A team member pads the patient's feet with gel or foam protectors and keeps the feet in a flexed position with the toes pointing downward, allowing them to hang over the end of the bed or to be elevated off the bed by placing padding under the patient's shins so the shins are high enough to avoid pressure on the tips of the toes.<sup>4</sup> This reduces the incidence of pressure ulcers and foot drop. The circulating nurse places the safety belt over the dorsal aspect of the patient's thighs just below the buttocks so the patient is secured but not so tightly that superficial venous return is impaired.<sup>7</sup>

The surgeon specifies the desired position for the patient's arms. The circulating nurse ensures that the patient's arms, elbows, and hands are well padded to protect against pressure ulcers and radial nerve injury and keeps the hands and wrists

## NEUROPOSITIONING (cont.)

in anatomical alignment in a neutral position.<sup>4,7</sup> Typically, the patient's arms are placed at his or her sides. After enclosing the patient's hands within foam protectors, team members place a pad around the elbow and place the arms against the body; if necessary, a draw sheet that extends above the elbows is tucked between the patient and OR bed mattress. In this position, the patient's palms are facing in towards the thighs.

Although the preferred arm position is at the patient's sides, the patient's arms can be placed on arm boards.<sup>4</sup> If it is necessary to place the arms on the arm boards, the nurse ensures that the patient's arms are abducted to less than 90 degrees to avoid stretching the brachial plexus, elbows are flexed, and palms are facing downward.<sup>4,6</sup> The nurse also ensures that the arms rest a little lower than the level of the chest and then places pads under the hands and elbows.<sup>9,15</sup>

When positioning has been accomplished, the circulating nurse makes sure that the following pressure points are well protected: forehead, eyes, nose, ears, chest, women's breasts, elbows, iliac crests, men's genitalia, posterior thighs, knees, edge of feet, and toes.<sup>4,6,7,9</sup> After the surgery, when the patient is placed in a supine position on a stretcher, the nurse assesses the skin and tissue integrity and documents any abnormalities.<sup>7,8</sup>

### LATERAL POSITION

The lateral position allows the anesthesia care provider better access to the patient's airway than does the prone or knee-chest position. The lateral position is indicated for

- some surgeries of the lumbar, thoracic, and cervical spines (eg, anterior thoracic discectomies and fusions);
- implantation of spinal cord electrodes and intrathecal pumps for pain management; and
- selected parietal, posterior fossa, supratentorial, or temporal craniotomies.<sup>8</sup>

The patient is anesthetized on the stretcher in the supine position. The circulating nurse ensures that all needed positioning devices are available, function correctly, and are the appropriate size for the patient. The circulating nurse ensures that the OR bed is ready with two gel pads overlaying a vacuum-pack positioning device, (ie, bean bag)

to stabilize the patient's torso.<sup>6</sup> The thickness provided by two layers of gel overlays is more effective than a single one to prevent pressure ulcers and provide adequate pressure redistribution for the hip and lateral thigh.

After induction of anesthesia, the anesthesia care provider lubricates the patient's eyes and tapes them closed. Depending on the anticipated length of surgery, the circulating nurse places SCDs on the patient's legs.

A minimum of four team members move the patient by lifting to prevent sheering injuries from the supine position on the stretcher to the lateral position on the OR bed. During transfer, team members maintain the patient's upper arm alongside the patient's body.

The neurological three-point headrest may be used to provide rigid fixation of the head. The patient's head also may be positioned on a pillow, gel donut, or gel horseshoe. Excessive pressure on the eyes could lead to postoperative blindness, so the anesthesia care provider positions the dependent eye and ear to ensure that they are free from pressure and that the patient's ear is not bent.<sup>12,13,14</sup> The team ensures that correct alignment of the cervical spine and thoracic vertebrae are maintained.

A team member places a gel roll between the bed and the upper ribs and axilla of the dependent side of the body (Figure 9).<sup>6,7,9</sup> This lifts the patient's chest and relieves pressure on the nerves and vessels of the brachial plexus, allowing for adequate blood flow in the arm, as well as facilitating chest expansion.<sup>6,7,9</sup> The axillary roll should be placed low enough to avoid direct compression of the axilla by the roll itself.

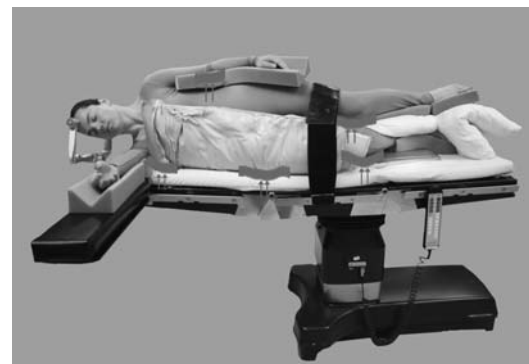
A team member moves the dependent shoulder slightly forward and free from pressure in order to ensure further protection to the brachial plexus. A female patient's breasts should rest freely and not be compressed by any positioning aids.<sup>4</sup> A team member places a gel pad under the patient's dependent arm, which is kept in supination to protect the ulnar nerve.<sup>9</sup> The anesthesia care provider frequently checks the radial pulse of the patient's dependent arm to

assess for adequacy of circulation. Poor circulation may be caused by partial compression of the axillary and brachial arteries from a poorly placed axillary roll.<sup>4,7</sup> The upper arm is kept in the same plane as the upper shoulder, with the forearm and wrist in a neutral functional position with the palm down. A team member places a foam/gel pad under the upper arm.

To maintain body alignment and stabilize the pelvis, a team member flexes the patient's dependent leg at both the hip and knee. A team member places a small gel cushion under the patient's dependent knee and places pillows between the patient's legs to help protect the common peroneal and saphenous nerves from excessive pressure of the nondependent leg on the dependent leg.<sup>7,9</sup> To avoid peroneal nerve injury, which can occur as a result of compressing the dependent knee against a hard surface, the circulating nurse ensures that the patient's dependent knee does not lie on top of the tubing from the intermittent SCDs. A team member extends or slightly flexes the nondependent leg to keep it in a neutral position. A team member places pads under the patient's feet to prevent pressure and keep them flexed.

The circulating nurse places the safety belt over the upper thigh. To add more stability to the patient's body, adhesive tape can be applied across the patient from one side of the bed frame to the other. Placing pads or sheet between the skin and the tape protects the patient's skin.

Figure 9



By: Benoit Ulrich

Patient in the lateral position.

When positioning has been accomplished, the circulating nurse checks the areas most vulnerable to pressure: ear, elbow, ribs, ilium, trochanter, medial and lateral condyle of the knee, malleolus, and foot edge.<sup>7</sup> The anesthesia care provider assesses the patient's eyes regularly while the patient is in the lateral position. At the end of surgery after the patient is transferred onto a stretcher, the nurse assesses and documents the status of the patient's skin and tissue integrity, paying special attention to the patient's upper rib cage and to the trochanter because of the extreme pressure on the dependent side.<sup>7,8</sup>

### PARK-BENCH POSITION

The park-bench position is a variation of the lateral position. In this position, the dependent shoulder and arm are positioned outside the OR bed and the arm is supported by a sling.<sup>16</sup> The patient's head may then be positioned at the extreme limits of rotation and flexion.<sup>17</sup> This position is advantageous for approaching low-lying cranial lesions and provides the surgeon with access to the anterior brainstem and foramen magnum,<sup>16</sup> as well as the cerebellopontine angle for resection of acoustic neuromas.<sup>18</sup>

The patient is positioned on the bean bag as in the lateral position. The surgeon places the patient's head on the neurosurgical headrest with the patient's head slightly flexed. When the patient is in the lateral position, the team lifts the patient (ie, to prevent sheering injuries) enough to place a gel roll between the bed and the upper ribs and axilla of the dependent side of the body.<sup>6,7,9</sup>

The team then lifts and moves the patient toward the head of the bed to let the dependent arm and shoulder rest lower than the body on a support attached to the head of the bed. A gel pad extending the length of the arm protects the entire arm, particularly the ulnar nerve. Correct placement of the axillary roll helps prevent injury to the brachial plexus and arteries by alleviating pressure on the dependent shoulder. The non-dependent arm is supported with pillows and gel pads to maintain correct body alignment and prevent stretching and compression of the nondependent brachial plexus and ulnar nerve. The same precautions as in the lateral position are

taken when positioning the lower part of the body.

When positioning has been accomplished, the circulating nurse checks the areas most vulnerable to pressure as described previously for the lateral position.<sup>7</sup> Because of the high risk of brachial plexus injury in this position, the circulating nurse assesses the patient as soon as the patient wakes from anesthesia and documents the status of the patient's skin and tissue integrity as well as any sensory or motor deficit, which he or she reports immediately to the surgeon and anesthesia care provider and to the PACU nurse during hand-off communication.<sup>7,8</sup>

### SITTING POSITION

Use of the sitting (ie, Fowler's) position remains controversial because of the potential for serious complications.<sup>19,20</sup> Usually, this position is used only for the surgical treatment of spasmodic torticollis and occasionally for posterior fossa exploration. This position provides surgical access to intracranial midline lesions in the posterior fossa and high cervical spine.<sup>7,20</sup> The sitting position improves cerebral venous drainage, lowers intracranial pressure, and promotes gravity drainage of cerebral spinal fluid and blood away from the surgical field.<sup>19,21</sup> This position also affords better access to the patient's airway compared with the prone position.<sup>2</sup>

Possible complications related to the use of this position include

- venous air embolism;
- hemodynamic instability;
- pneumocephalus;
- quadriplegia; and
- compressive peripheral neuropathy.<sup>19,20</sup>

Venous air embolism can occur in any position where there is an open vein and a negative pressure gradient between the surgical site and the right atrium.<sup>7,19,20</sup> Venous air embolism during neurosurgery may be more likely but is not exclusive to the sitting position and has been reported in the prone and supine positions.<sup>20</sup>

The circulating nurse verifies the availability and functionality of all required positioning equipment and supplies before induction of anesthesia. The circulating nurse places an antishock suit with

separate inflatable chambers for the legs and the abdomen on the OR bed over a full-length gel overlay and a buttock gel pad (Figure 10). The buttock gel pad prevents excessive pressure on the sciatic nerve and coccyx. When the patient is transferred to the OR bed, the circulating nurse asks the patient to verify that the buttock gel pad is in the most comfortable position. This step is vital because if the patient is awake, he or she can guide the team and ensure that the gel covers the pressure area created when sitting.

The anesthesia care provider induces general anesthesia with the patient in the supine position. There is significant preparation to be completed by the anesthesia team to appropriately monitor the physiological changes associated with the sitting position.

General anesthesia exaggerates normal physiological changes that occur when the patient is placed in a sitting position. Venous return decreases because venous blood pools in the lower extremities, a situation that is exacerbated by the vasodilating and myocardial depressant effects of general anesthetics. This physiologic effect emphasizes the importance of applying TED stockings and SCDs. The circulating nurse helps the anesthesia care provider put the antishock suit on the patient, although it may not necessarily be inflated. Ultimately, the anesthesia care provider is responsible for the use of this device. The antishock suit may be inflated if a venous air embolism is detected.

The neurosurgeon places the patient's head in the neurosurgical headrest and assumes responsibility for holding the patient's head while the rest of the team positions the OR bed. The OR bed is converted from supine to sitting by elevating the upper half to raise the back and flexing the lower half to lower the legs. The entire bed is rotated backward to support the patient in a semi recumbent chair-like position (Figure 11). All those steps are accomplished slowly to prevent hypotension.<sup>4,7,19,20</sup> When the desired amount of head flexion is achieved, a team member secures the neurosurgical headrest anteriorly to a cross-bar attachment that is secured to the side rails of the OR bed to allow rapid lowering of the head in case of emergency.

## NEUROPOSITIONING (cont.)

A team member places a pillow behind the patient's back to support and protect the scapulas from pressure created by the edge of the OR bed. The patient's arms are placed on armrests attached on sidebars. To protect the ulnar nerves, a team member slightly flexes the patient's arms at the elbows, places pads under the arms, and ensures that the hands and wrists are aligned in a neutral position with the palms down.<sup>4</sup>

In the sitting position, the most frequently damaged nerve in the lower extremities is the common peroneal nerve.<sup>9</sup> Damage to the common peroneal nerve or compression or stretching of the sciatic nerve can lead to a foot drop.<sup>4</sup> Team members ensure that excessive flexion of the knees is avoided; hyperflexion of the knees particularly stretches the peroneal nerve and compresses it against the head of the fibula.<sup>4</sup> Team members place pads under the patient's heels to help minimize this pressure. The sciatic nerve is exposed to increased pressure in this position.<sup>7</sup> A team member places a pillow under the patient's legs and flexes the patient's knees to help minimize strain on the sciatic nerves and lower back.<sup>7</sup> The circulating

Figure 10



OR bed set-up with the required equipment for the sitting position.

Figure 11



Patient in the sitting position.

nurse places the safety belt two inches above the knees as described for the supine position.

When positioning has been accomplished, the circulating nurse checks the areas most vulnerable to pressure – the upper and lower back, elbows, ischial tuberosities, coccyx, popliteal space, and heels.<sup>7</sup> After surgery is complete, the circulating nurse assesses and documents the status of the patient's skin and tissue integrity for redness, blanching, or bruising.<sup>7,8</sup> Upon the patient's transfer to the stretcher, the circulating nurse turns the patient on his or her side in order to do a thorough evaluation of the vulnerable pressure sites.<sup>7,8</sup>

### SAFELY POSITIONING THE NEUROSURGICAL PATIENT

Perioperative nurses are the patient's advocates in all aspects of care, one of which is patient safety related to positioning. The circulating nurse represents the coordinating link between the patient's needs and the surgical team's responsibilities<sup>4,7</sup> and, therefore, must ensure that all members of the surgical team perform patient care at the highest level according to nationally accepted standards, recommended practices, and guidelines.<sup>4,5,8</sup>

In the OR, improved padding supplies, equipment, and accessories have the ability to reduce, but not eliminate, the effects of excessive pressure.<sup>4</sup> Advance planning, meticulous attention to the details of positioning, and monitoring by perioperative nurses, however, can prevent serious complications.

## NEUROPOSITIONING (cont.)

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ORNAC Standards pertaining to this article can be found in the Operating Room Nurses Association of Canada (2007) (ORNAC). *Recommended Standards, Guidelines, and Position Statements for Perioperative Registered Nursing Practice* (8<sup>th</sup> edition). In Module 3, p. 19-22, Standard 6.

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