

POSITIONING

As Operating Room Nurses, we provide care and support to patients before, during, and after surgery. OR nurses are responsible for maintaining a sterile environment in the operating room, monitoring the patient during surgery, and coordinating care throughout the process. We are also responsible for making sure the OR team provides the patient with the best care possible. Positioning of the patient properly must be achieved to assure that the patient received the best care possible.

The Operating Room Nurse begins by assessing each patient preoperatively. It is this assessment which influences how we deal with each individual patient in the operating room. One very important process is consistency, so that you never skip a step. The more we are pushed in the pre-op process to meet our hospitals goals for our SCIP'S measures, the more challenges we have to meet our patients positioning needs.

Before greeting the patient in pre-op, it is important for the Operating Room nurse to check for any Physician preferences. The Physician preference card, comment section in the computer charting (check with your facility), are all ways to confirm any physician positioning requests. Once confirming the patient information, it is vital to assess the patient for range-of-motion limitations. If the patient does have range-of-motion limitations, make sure to address these issues in the pre-operative phase. If the patient stated that they have back problems, make sure to ask if they sleep with a pillow under their knees to relieve back pressure. This pre-operative assessment allows the nurse to properly care for the patient intra-operatively. Knowing that a pillow relieves back pressure for the patient, place a pillow under the patient's legs intra-operatively to maintain an acceptable comfort level for the patient. Assess the patient for any implants that may affect surgical positioning. It is vital that these assessments are made in the preoperative phase.

It is also important to assess the patient for skin break down. If the patient states that they do have skin break down, make sure that it is documented. The pre-operative nurse and the operating room nurse should discuss and confirm documentation of the skin assessment. If the patient has an open wound, it is best to photograph the wound prior to surgery. The

photograph is the best documentation as to the wound level pre-operatively versus post-operatively.

Once the patient is in the operating room, positioning should be addressed during the pre-incision surgical pause. The operating room nurse has already confirmed positioning with the preference card or computer charting, but the Physician may change his/her mind. The surgical pause is the perfect time to address any positioning needs or concerns with the entire intra-operative team. The patient is awake during this phase and may add important information that they may not have thought to address in the pre-op process. If any additional equipment for positioning is needed, pre induction of the patient is the optimal time to gather the equipment. Once the patient is induced, the surgical team begins positioning the patient for surgery. After the correct positioning is completed, the electro cautery pad should be placed. Placing the bovie pad after positioning assures that it is not moved or damaged during the positioning process. These positioning topics and many more will be addresses as we run through the steps of the correct positioning of the operating room patient.

Intra-operative positioning is the finely honed art of moving and securing human anatomy into place to ensure the best surgical site exposure with minimal compromise of the patient's physiologic functions (eg, airway patency, gas exchange, lung excursion, circulation) and minimal mechanical stress on the patient's joints. Positioning patients safely for surgical procedures is a routine intra-operative nursing responsibility, and facilitating positive patient outcomes is an expected standard of professional care. This continuing education on Positioning provides perioperative nurses a review of anatomy and physiology, positioning injuries, prevention of positioning injuries, patient risk factors, positioning considerations, common intraoperative positions, and general pre/post and perioperative considerations.

Preparation for positioning

Before the patient is taken into the operating room, the circulating nurse should perform the following steps:

1. Review the proposed position by referring to the surgeon's preference card in comparison with the daily printed scheduled procedure and notes in the computer charting if available.
2. Assess for any patient specific positioning needs.
3. Ask the surgeon for assistance if unsure how to position the patient.
4. Check the working parts of the operating room bed before bringing the patient into the room.
5. Assemble and test all table attachments and protective pads anticipated for the surgical procedure and have them immediately available at the bedside.
6. Review the plan of care for the unique special needs for the patient including items like implants.
7. Decide whether or not the patient would benefit from lifting equipment on the operating room bed (Hover Mat, etc).

Standard Positions

There are five standard positions:

1. **Supine:** Patient is lying flat on their back with their face upward.
2. **Prone:** Patient is lying horizontal with face and front downward on the OR bed.
3. **Lateral:** Patient on side with the affected/surgical side up.
4. **Sitting:** Patient's head of bed is raised; bottom of the bed is lowered so patient appears to be in a lounge chair sitting.
5. **Lithotomy:** Patient is on their back with their legs flexed and usually placed in some type of stirrup to hold this position. The legs and thighs are abducted. The lower part of the bed is taken off and lowered for access to the patient.

Often, these intra-operative positions are modified according to surgeon's preferences, surgical approach, and patients' physiologic requirements.

PRELIMINARY CONSIDERATION

Positioning for a surgical procedure is an important duty of the Circulation Nurse. Correct patient positioning is vital for a successful patient outcome for any surgical procedure. Positioning requires a detailed knowledge of anatomy and physiologic principles, as well as familiarity with the necessary equipment. It also requires the knowledge of knowing where to find the necessary positioning supplies. **Safety** is always a prime consideration with positioning.

The selection of the surgical position is made by the surgeon and should be found on the surgeon preference card or under the comment section in the facilities computer programming. Factors such as age, height, weights, cardiopulmonary status, and preexisting disease condition (arthritis, allergies) also should be incorporated into the plan of care, preoperatively; the patient should be assessed for alterations in skin integrity, for joint mobility, and for the presence of joint or vascular prostheses. The main objectives for any surgery or procedure related to positioning are as follows:

- Optimize surgical-site exposure for the surgeon
- Minimize the risk for adverse physiologic effects
- Facilitate physiologic monitoring by the anesthesia provider
- Promote safety and security for the patient

SUPINE

Supine position is used for the majority of surgical procedures. When positioned supine, the patient is placed on his or her back on the OR bed. The patient lies flat on his or her back with arms secured at the sides with the lift sheet, and the palms extend along the side of body in their natural resting position. The elbows may be protected with plastic sleds. The patient's spinal column should be in a straight line with his or her legs parallel on the operating bed. A safety belt is placed across the thighs 2 inches above the knees. Small positioning pads may be placed under the head and popliteal area to relieve pressure on the spine as needed. The heels are protected from pressure by a pillow, gel pad, or donut. The feet must not be in prolonged plantar flexion, or nerve stretch injury could result. To prevent footdrop, the soles may be supported by a pillow or padded footboard.

PRONE

When positioned prone, the patient is placed face down on the operating bed. When the prone position is used, the patient is anesthetized and intubated in the supine position on the locked gurney. The patient's arms are along his or her sides. When the anesthesia provider gives permission, the patient is slowly and cautiously shifted toward the operating bed in the supine position and then turned onto the abdomen onto the operating bed. The patient's body is rotated as if rolling a log; a team of at least four to six people is needed to maintain body alignment during this transfer. The anesthesia provider controls the patient's head and airway while the rest of the patient's body is moved by the team.

Chest rolls or bolsters under the axilla along the sides of the chest from the clavicles to the iliac crests raise the weight of the body from the abdomen and thorax. The weight of the abdomen will fall away from the diaphragm and keep pressure off the vena cava and abdominal aorta. This facilitates respirations, although vital capacity and cardiac index are reduced. To ensure cardiac filling and to reduce hypotension, venous return from the femoral veins and inferior vena cava is uninterrupted. Female breasts should be moved laterally to reduce pressure on them. Male genitalia should be free from pressure. Pendulous skinfolds should not be crimped under the patient in any manner.

The arms may lie supported along the sides of the body, with the palms up or inward toward the body. The head can be turned to one side or positioned face down on a padded donut to prevent pressure on the ear, eye, and face. Clearance of the airway must be ensured. A serious complication of the prone position is blindness caused by ischemia of the vascular system of the eye.

A pillow or padding under the anterior aspect of the ankles and the dorsa of the feet prevents pressure on the toes and elevates the feet to aid venous return. Do not permit the patient's toes to extend beyond the foot of the bed. Donuts under the knees prevent pressure on the patellae. The safety belt is placed over the calves to prevent flexion of the lower legs. Care is taken not to compress the lower legs. An additional belt can be positioned over the posterior thighs as an added precaution.

LATERAL

The lateral position is when the patient is positioned on his or her left or right side. For lateral positioning, the operating bed remains flat. The patient is anesthetized and intubated in the supine position and then turned to the unaffected side. In the right lateral position, the patient lies on the right side with the left side up (for a left-sided procedure) the left lateral position exposes the right side.

The patient is turned by no fewer than four people to maintain body alignment and achieve stability. The patient's back is drawn to the edge of the operating room bed. The knee of the lower leg is flexed slightly to provide stabilization, and the upper leg is flexed slightly to provide counterbalance. The flexed knees may require padding to prevent pressure and shearing force. In addition, a large, soft pillow is placed lengthwise between the legs to take pressure off the upper hip and lower leg and therefore prevent circulatory complication and pressure on the peroneal nerve. The ankle and foot of the upper leg should be supported to prevent footdrop. Bony prominences should be padded.

The patient's arms may be placed on a padded double arm board, with the lower arm palm up and the upper arm slightly flexed with the palm down. Blood pressure should be measured from the lower arm. As an alternative, the upper arm can be positioned on a padded Mayo stand. A water bag or pressure reduction pad under the axilla protects neurovascular structures. The shoulders should be in alignment.

The patient's head is in cervical alignment with the spine. The head should be supported on a small pillow between the shoulder and neck to prevent stretching the neck and brachial plexus and to maintain a patent airway.

SITTING POSITION (Modified Fowler)

In the sitting position, the back of the operating bed is elevated to a vertical plane, a foot board is placed perpendicular on the bed to support the patient's feet, and the patient is placed over the break in the operating bed. The shoulders and torso should be supported with body straps but not so tightly that respirations and circulation are impeded. Pressure points are padded to reduce the risk of sciatic nerve damage. The flexed arms rest on a large pillow on the pad or a pillow on an adjusted table in front of the patient. The head is seated forward in a cranial headrest, shoulder table

attachment or resting on the operating bed. A padded footboard may be placed to maintain the patient's feet in an upright position and deter sliding down on the bed.

Areas that may be affected by pressure injuries include the patient's occiput, scapulae, back of the knee, coccyx, ischial tuberosities, and calcaneous. Positioning injuries can occur to the patient's supra-scapular, ulnar, sciatic, perineal, and anterior tibial nerves as a result of inadequate padding and proper body alignment. Another potential sequela of the sitting position is the increased likelihood of air embolism due to negative venous pressure in the patient's head and neck. Air can enter through skull pin sites and through open venous channels and sinuses in the exposed brain. One advantage of the sitting position is the positive effect on the patient's respiratory system. Lung excursion and diaphragmatic activity are facilitated by the unrestricted movements of the thoracic cavity.

LITHOTOMY

Lithotomy position is when the patient lies with his or her legs abducted and elevated in stirrup devices attached to the operating bed. The patient's buttocks rest align the break between the body and leg sections of the operating bed. A padded metal bootboard is used as an operating bed extension so the patient's legs do not extend over the foot of the operating bed before placing the legs in the upright position.

Stirrups are secured in sockets on each side of the operating bed rail at the level of the patient's upper thigh. They are adjusted at equal height on both sides and are an appropriate height for the length of the patient's legs to maintain symmetry when the patient is positioned. After the patient is anesthetized, the safety belt is removed and the patient's legs are raised simultaneously by two people. Each person grasps the sole of a foot in one hand and supports the calf at the knee area with the other. The knees are flexed, and the legs and feet are placed inside the stirrup. For sling, or candy cane stirrups, the feet are placed in the fabric slings of the stirrups at a 90 degree angle to the abdomen. One padded loop stirrup encircles the sole; the other padded loop goes around the ankle.

Simultaneous movements as the knees are flexed is essential to avoid straining the lower back. If the patient's legs are properly placed, undue abduction and external rotation are avoided; the leg or ankle must not touch the metal stirrup. Padding is placed as necessary. If the legs are put in stirrups before the induction of anesthesia, the patient can identify discomfort and pressure on the back of the legs.

After the patient's legs are placed in the stirrups, the lower section of the mattress is removed and the lower section of the operating bed is lowered. The buttocks must not extend beyond the edge of the operating bed, which would strain the lumbosacral muscles and ligaments as the weight of the body rests on the sacrum.

The hands should not extend along the operating bed, where they could be injured during manipulation of the operating room bed. Bilateral arms may be extended at side or tucked to the side.

At the conclusion of the surgical procedure, the leg section of the operating bed is raised and the lower section of the mattress is replaced. The patient's legs are removed simultaneously from the stirrups and lowered slowly to prevent hypotension as blood reenters the legs and leaves the torso. To prevent wide abduction of the thighs, the legs are fully extended and brought together as they are lifted from the stirrups.

Circulating blood volume may be depleted when the patient's legs are lowered to the bed at the end of the surgical procedure and blood is diverted quickly to the patient's peripheral circulation. Gravitational forces return approximately 500 to 800 ml of blood to the patient's legs, which depletes the circulating volume and decrease the patient's blood pressure. Slow, simultaneous positioning of the patient's legs at the beginning and end of the surgical procedure allows the body to adjust to shifting blood volumes. In addition, lowering and raising both legs simultaneously prevents possible hip dislocation or lumbar muscle strain.

ANATOMY AND PHYSIOLOGY

The skin is the largest organ in the human body and the primary body system affected by pressure injuries. An understanding of the skin's anatomy and physiology helps perioperative nurses better appreciate injury mechanisms associated with common intraoperative position. The skin protects the human body from chemical and bacterial invasions, insulates internal structures against heat and cold, and plays a role in the regulation of body temperature.

Epidermis is the outer portion of the skin. The thickness of the epidermis varies from 0.04 mm on the eyelids to 1.6 mm on the palms of the hands, with the average thickness over the majority of the body measuring 0.1 mm. The epidermis is composed of many layers. The uppermost layer consists mainly of nonliving cells that are shed from the body daily. The body replenishes epidermal cells daily, and the epidermis can regenerate itself if injured.

A key factor in epidermal regeneration is the basal membrane that comes in contact with the dermis (i.e., inner layer of skin). The basal membrane layer is only one cell in depth and produces cells at a rate comparable to the cells lost from the outer layer of the epidermis. The epidermis replaces itself completely in about three to four weeks. The structures of the epidermis include hair follicles, sebaceous glands, eccrine (i.e., sweat) glands, apocrine (i.e., scent) glands, and pilosebaceous units (i.e., hair, follicles, sebaceous glands that produce sebum). The epidermal layer does not contain blood vessels or nerves.

Dermis is the inner portion of the skin and is anchored to the underlying muscle or bone by connective tissue. Depending of its location, the dermis can be 15 to 40 times thicker than the epidermis. The dermis of the skin has two layers, the papillary and the reticular layers. These layers are composed of collagen, elastin, and proteoglycans.

Lying within the connective tissue structures of the dermis are blood vessels, nerves, lymphatic vessels, and cellular elements. After the dermal layer is damaged, it does not regenerate new cells, but replaces itself with granulation tissue composed of collagen and newly formed blood vessels. This granulation has 70% of the tensile strength of the original dermal cells.

RESPONSIBILITY FOR PATIENT POSITIONING

The circulating nurse is responsible for placing the patient in a surgical position, with the guidance from the anesthesia provider and the surgeon. Patient positioning is a shared responsibility among all team members. The anesthesia provider has the final word on positioning when the patient's physiologic status and monitoring are in question.

There are always special considerations that need to be made. In cases of complex positioning or positioning patients who are obese, the plan of care includes the need for additional help in lifting and /or positioning. Special devices or positioning aids may be necessary. The weight tolerance of the mechanism and balance of the operating bed should be considered. The manufacturer's recommendations should be consulted for guidance in selecting the appropriate bed. To avoid questions or confusion, the weight tolerance should be clearly labeled on every operating bed.

TIMING OF PATIENT POSITIONING AND ANESTHETIC ADMINISTRATION

Moving the patient from the gurney to the operating bed or vice versa requires that both surfaces are securely locked and stable. Someone should be stationed on the far sides of the receiving surface to prevent the patient from tumbling off the edge. There should always be personnel at the head, foot, and both sides of the patient to prevent dependent parts from sliding off the table. The neck of the patient's gown should be untied to prevent entanglement and chocking as the patient moves or is moved from one surface to another.

After transfer from the transport stretcher to the operating room bed, the patient is usually supine (face up on his or her back). Privacy is maintained by a warm cotton blanket, and the thigh strap is positioned in clear sight of the entire team. The patient may be anesthetized in a supine position and then repositioned for the surgical procedure. Some patients are positioned and then anesthetized if their physiologic status requires special care. If the patient is having a procedure performed while in a prone position and under general anesthesia, he or she is anesthetized and intubated on the gurney. A minimum of four people is required to place the patient safely in the prone position on the operating bed. Commonly, more

personnel are required for a safe transfer between surfaces when the patient is fully under anesthesia.

Several factors influence the time at which the patient is positioned: the site of the surgical procedure; the age and size of the patient; the technique of anesthetic administration; and if the patient is conscious, pain on moving. The patient is not moved, positioned, or prepped until the anesthesia provider turns the patient over to the surgical team.

PREPARATIONS FOR POSITIONING

Before the patient is brought into the OR, the circulating nurse should do the following:

1. Review the proposed position by referring to the surgeon's preference card in comparison with the scheduled procedure.
2. Ask the surgeon for assistance if unsure how to position the patient.
3. The circulating nurse will assess for any patient specific positioning needs.
4. Check the working parts of the operating room bed before bringing the patient into the room,
5. Assemble and test all table attachments and protective pads anticipated for the surgical procedure and have them immediately available for use at the bedside.
6. Review the plan of care for unique need of the patient.

Safety Measures in OR

Safety measures, including the following, are observed while transferring, moving, and positioning patients:

1. The patient is properly identified before being transferred to the operating bed and the surgical site is affirmed according to facility policy. The patient should be properly marked by the surgeon, correct side.
2. The patient is assessed for mobility status. This includes determination of the patient's ability to transfer between the transport stretcher and the operating bed.

3. The operating bed and transport vehicle are securely locked in position, with the mattress stabilized during transfer to and from the operating bed. Velcro strips or other means should be employed to maintain the stability of the mattress of the two surfaces.
4. Two people should assist an awake patient with the transfer by positioning themselves on each side of the patient's transfer path. The person on transport stretcher assists the patient in moving toward the operating bed. The person on the opposite side prevents the patient from falling over the edge of the operating bed. Untie the ties of the patient's gown or blanket to avoid becoming lodged between the two surfaces or under the bottom of a moving patient. Maintain the patient's dignity at all times.
5. Adequate assistance in lifting unconscious, anesthetized, obese, or weak patients is necessary to prevent injury. A minimum of four people is recommended, and transfer devices and lifters may be used. The patient is moved on the count of three, with the anesthesia provider giving the signal. Sliding or pulling the patient may cause dermal abrasion or injury to soft tissue. Dependent limbs can cause a counterbalance and cause the patient to fall to the floor.
6. The anesthesia provider guards the head of the anesthetized patient at all times and supports it during movement. The head should be kept in a neutral axis and turned as little as possible to maintain the airway and vertebral circulation.
7. The physician assumes responsibility for protecting an unsplinted fracture during movement.
8. The anesthetized patient is not moved without permission of the anesthesia provider.
9. The anesthetized patient is moved slowly and gently to allow the circulatory system to adjust and to control the body during movement.
10. No body part should extend beyond the edges of the operating bed or contact metal parts of unpadded surfaces.
11. Body exposure should be minimal to prevent hypothermia and preserve dignity.
12. Movement and positioning should not obstruct or dislodge catheters, drains, intravenous infusion tubing, oxygen cannulas, and monitors.
13. The arm board is protected to avoid hyperextending the arm or dislodging the IV cannula. The surface of the armboard pad and the mattress of the operating bed should be of equal height. Hyper abduction is avoided to prevent brachial plexus stretch.

14. When the patient is supine, the ankles and legs must not be crossed. Crossing the ankles and legs creates occlusive pressure on blood vessels and nerves, and pressure necrosis may occur. The patient would be at risk for deep vein thrombosis (DVT).
15. When the patient is prone, the thorax is relieved of pressure by using chest rolls (subclavicle to iliac crest) to facilitate chest expansion with respiration. The chest rolls should be adequately secured to the table to prevent shifting. The abdomen should remain dependent to decrease abdominal venous pressure. Padding should be placed under the dorsum of the feet to prevent pressure on the toes. In the event of cardiac arrest, a transport cart should be available for immediate emergency repositioning into the supine position and subsequent resuscitation.
16. When the patient is positioned lateral, a pillow is placed lengthwise between the legs to prevent pressure on bony prominences, blood vessels, and nerves. This also relieves pressure on the superior hip.
17. During articulation of the operating bed, the patient is protected from crush injury at the flex points of the operating bed.
18. When the operating bed is elevated, the patient's feet and protuberant parts are protected from compression by overbed tables, Mayo stands, and frames. An adequate clearance of 2 to 3 inches is maintained.
19. Surfaces should not create pressure on any body part. Alternating or pressure-relieving surfaces should be used. Rolled blankets and towels can create pressure because they do not allow for relief of compression at the contact surface. A gel pad or other alternating pressure pads should be used.

Complication caused by positioning

See table 1:1

Complication Caused by Positioning

Table 1:1

Homodynamic instability or orthostatic position

Poor ventilation by thoracic compression

Peripheral nerve injury caused by compression or stretch

Tissue damage from crush or shearing force

Ischemia of hair-bearing scalp, causing bald spots

Compartment syndrome

Pressure necrosis

Digit amputation in table bends

Blindness from optic nerve ischemia

Corneal abrasion

Ischemic limb from arterial occlusion

Venous emboli

Vertebral injury

Panic attacks and feelings of claustrophobia in awake patient

ANATOMIC AND PHYSIOLOGIC CONSIDERATIONS

A patient's tolerance of the stresses of the surgical procedure depends greatly on normal functioning of the vital systems. The patient's physical condition is considered, and proper body alignment is important. Criteria are met for physiologic positioning to prevent injury from pressure, crushing, pinching, obstruction, or stretching. Each body system is considered when planning the patient's position for the surgical procedure.

Respiratory Considerations

Unhindered diaphragmatic movement and a patent airway are essential for maintaining respiratory function, preventing hypoxia, and facilitating induction by inhalation. Chest excursion is a concern because inspiration expands the chest anteriorly. Some positions limit the amount of mechanical excursion of the chest. Some hypoxia is always present in a horizontal position because the anteroposterior diameter of the ribcage and abdomen decreases. The tidal volume, the functional residual capacity of air moved by a single breath, is reduced by as much as one third when a patient lies down, because the diaphragm shifts cephalad. Therefore, there should be no constriction around the neck or chest.

The patient's arms should be at his or her side, on armboards, or otherwise supported – not crossed on the chest unless this is absolutely necessary for the procedure. Patients have additional respiratory compromise if they are obese, smoke, or have pulmonary disease.

Circulatory Considerations

Adequate arterial circulation is necessary for maintaining blood pressure, perfusing tissues with oxygen, facilitating venous return, and preventing thrombus formation. Occlusion and pressure on the peripheral blood vessels are avoided. Body support and restraining straps must not be fastened too tightly; Anesthetic agents alter normal body circulatory mechanisms, such as blood pressure. Some drugs cause constriction or dilation of the blood vessels, which is further complicated by positioning.

Peripheral Nerve Considerations

Prolonged pressure on or stretching of the peripheral nerves can result in injuries that range from sensory and motor loss to paralysis and wasting. The extremities, as well as the body, should be well supported at all times. The most common sites of injury are the divisions of the brachial plexus and the ulnar, radial, peroneal, and facial nerves; the axons may be stretched or disrupted. Extremes of position of the head and arm greater than 90 degrees can easily injure the brachial plexus. If the patient is improperly positioned, the ulnar, radial, and peroneal nerves may be compressed against the stirrups or the operating bed.

Arthroscopy leg holders and tourniquets can cause crushed or transected nerve injury. Femoral nerve injury can be caused by retractors during pelvic procedures. Sciatic nerve injury may be caused by tissue retraction of manipulation during hip surgery or extremes of lithotomy position. Facial nerve injury may result from a head strap that is too tight or from manually elevating the mandible too vigorously to maintain the airway.

Musculoskeletal Considerations

A strain on muscle groups results in injury or needless postoperative discomfort. An anesthetized patient lacks protective muscle tone. If the head is extended for a prolonged time, the patient may suffer more pain from the resulting stiff neck than from the surgical wound. Care is taken not to hyperextend a joint, which not only causes postoperative pain but also may contribute to permanent injury to an extremity. Elderly or debilitated patients with osteoporosis or other bone disease may suffer fractures.

When turning a patient, always keep the spine in alignment by grasping the shoulder girdle and hip in a logrolling fashion. Do not turn or elevate a patient by grasping only a hip and twisting the spine. Proper body alignment is maintained.

Soft tissue Considerations

Body weight is distributed unevenly when the patient lies on the operating bed. Weight that is concentrated over bony prominences can cause skin pressure ulcers and deep tissue injury. These areas should be protected from constant external pressure against hard surfaces, particularly in patients who are thin or underweight. In addition, tissue that is subjected to prolonged mechanical pressure (e.g., a fold in the skin under an obese or

malnourished patient) will not be adequately perfused. Wrinkled sheets and the edges of a positioning device under the patient can cause pressure on the skin. Foam pads are not adequate to relieve pressure, because they compress and do not alternate pressure. Towel and sheet rolls do not relieve pressure because they are unyielding to the patient's body weight. Gel pads are preferred, According to AORN Standards; Recommended Practices, and Guidelines (2006); positioning devices should maintain normal capillary interface pressure of 23 to 32 mm HG or less to prevent pressure injuries. Blood flow and tissue perfusion are restricted at higher pressures.

Pressure injuries are more common after surgical procedures that last 1 hour or longer. During lengthily procedures, the head and other body parts should be repositioned if possible. Patients who are debilitated, poorly nourished, and diabetic are at particularly high risk for pressure ulcers and alopecia (permanent bald spots from pressure).

The contributing effects of gravity in pressure injuries can be illustrated by making a fist with each hand, aligning the fists at the knuckles, and pressing them firmly together. This exercise becomes uncomfortable within seconds, but the pressure exerted by opposing fists is extremely mild compared to the pressure experienced by the human body on the operating bed. Pressure injuries usually occur over bony prominences or in deep tissue.

PRESSURE ULCERS

Pressure, friction, and shear forces can combine to produce pressure ulcers. The Agency for Health Care Policy and Research defines a pressure ulcer as any lesion caused by unrelieved pressure that results to damage to underlying tissue. Damage may be observed immediately (e.g. reddened appearance to skin) or may not appear until several days after the tissue is exposed to unrelieved pressure. Typically, pressure injuries from intraoperative positioning develop first in muscle and subcutaneous tissues and progress outward toward the dermal and epidermal layers of patient's skin. Two to three hours of unrelieved pressure on tissues can result in dermal pressure ulcers.

Sustained pressure for even short periods of time may produce a condition known as reactive hyperemia (i.e., reddened skin that develops after the arrest and subsequent restoration of the blood supply to a body part). Reactive hyperemia resolves without treatment and is differentiated easily from pressure injuries by noting that the reddened skin area blanches

under fingertip pressure. These reddened skin areas usually fade within one half to three fourth of the length of the time that pressure was applied. For example, a reactive hyperemia lesion noted after two hours of immobility in a surgical position should disappear within one to one and one half hours after surgery.

Pressure ulcer formations are categorized in stages, depending on the degree of tissue damage. Treatment is customized to the stage of ulcer development. Stage I: Intact skin is reddened and does not blanch to fingertip pressure. This lesion signifies the beginning of pressure injury. Stage II: Skin is abraded, blistered, or has shallow craters. This stage is characterized by partial-thickness skin loss involving the epidermis and dermis. Stage III: Deep craters are present with or without undermining deep sinus tract in tissues. Full-thickness skin loss occurs and may extend down to, but not through underlying fascia. Stage IV: Extensive damage to muscle, bone, and supporting structures develops, and undermining, deep sinus tracts may be present. See Pressure ulcer intervention guidelines based on Braden Scale, Table 1:2.

Braden Risk Assessment Scale

Factors Further Increasing Risk

Peripheral Vascular Disease, impaired circulation, vasoconstriction drugs, braces or stabilizing equipment, diabetes, CHF, COPD, history of ulcers, preterm neonates, obesity/thin $30 > \text{BMI} < 19$, Critical labs: prealbumin (reflects visceral protein stores) mild depletion = 10-15, moderate depletion = 5-10, severe depletion = <5.

- Instructions:**
1. Assess patient's risk to skin breakdown.
 2. To calculate a Braden Score, choose the appropriate score from each category and total them.
 3. If a category score falls between two numbers, choose the lower score.
 4. Calculate a Braden Score upon admission and every 24 hours afterward and document on the Patient Care Flow Sheet.
 5. If score is 18 or lower, initiate recommended interventions for each category. (See back side.)

Braden Category	Braden Score: 1	Braden Score: 2	Braden Score: 3	Braden Score: 4
Sensory Perception Ability to respond meaningfully to pressure-related discomfort.	Completely limited Unresponsive (does not moan, flinch or grasp) to painful stimuli, due to diminished level of consciousness or sedation OR Limited ability to feel pain over most of body surface.	Very limited Responds only to painful stimuli; Cannot communicate discomfort except by moaning or restlessness. OR Has sensory impairment, which limits the ability to feel pain or discomfort over 1/2 of the body.	Slightly limited Responds to verbal commands but cannot always communicate discomfort or need to be turned. OR Has some sensory impairment, which limits ability to feel pain or discomfort in 1 or 2 extremities.	No limitation Responds to verbal commands. Has no sensory deficit, which would limit ability to feel or voice pain or discomfort.
Moisture Degree to which skin is exposed to moisture.	Constantly Moist Skin is kept moist almost constantly by perspiration, urine, etc. Dampness is detected every time patient is moved or turned.	Moist Skin is often but not always moist. Linen must be changed at least once a shift.	Occasionally Moist Skin is occasionally moist, requiring an extra linen change approximately once a day.	Rarely Moist Skin is usually dry; linen requires changing only at routine intervals.
Activity Degree of physical activity.	Bedfast Confined to bed.	Chair fast Ability to walk severely limited or nonexistent. Cannot bear own weight and/or must be assisted into chair or wheelchair.	Walks Occasionally Walks occasionally during day but for very short distances, with or without assistance. Spends majority of each shift in bed or chair.	Walks Frequently Walks outside the room at least twice a day and inside the room at least once every 2 hours during waking hours.
Mobility Ability to change and control body position.	Completely Immobile Does not make even slight changes in body or extremity position without assistance.	Very Limited Makes occasional slight changes in body or extremity position but unable to make frequent or significant change independently.	Slightly Limited Makes frequent though slight changes in body or extremity position independently.	No Limitations Makes major and frequent changes in position without assistance.
Nutrition Usual food intake pattern.	Very Poor Never eats a complete meal. Rarely eats more than 1/3 of any food offered. Eats 2 servings or less of protein (meat or dairy products) per day. Take fluids poorly. Does not take a liquid dietary supplement. OR Is NPO and/or maintained on clear liquids or IV for more than 5 days.	Probably Inadequate Rarely eats a complete meal. Generally eats only about 1/3 of any food offered. Protein intake includes only 3 servings of meat or dairy products per day. Occasionally will take a dietary supplement. OR Receives less than optimum amount of liquid diet or tube feeding.	Adequate Eats over 1/2 of most meals. Eats a total of 4 servings of protein (meat and dairy products) each day. Occasionally will refuse a meal, but will usually take a supplement if ordered. OR Is on tube feeding or TPN regimen, which probably meets most of nutritional needs.	Excellent Eats most of every meal. Never refuses a meal. Usually eats a total of 4 or more servings of meat and dairy products. Occasionally eats between meals. Does not require supplementation.
Friction & Shear	Problem Requires moderate to maximum assistance in moving. Complete lifting without sliding against sheets is impossible. Frequently slides down in bed or chair, requiring frequent repositioning with maximum assistance. Spasticity, contractions or agitation lead to almost constant friction.	Potential Problem Moves feebly or requires minimum assistance. During a move, skin probably slides to some extent against sheets, chair, restraints or other devices. Maintains relatively good position in chair or bed most of the time but occasionally slides down.	No apparent problem Moves in bed and in chair independently, and has sufficient muscle strength to lift up completely during move. Maintains good position in bed or chair at all times.	

Pressure Ulcer Intervention Guidelines Based on Braden Score

Braden Category	Braden Score: 1	Braden Score: 2	Braden Score: 3	Braden Score: 4
Sensory Perception	<p>Completely limited Skin assessment and inspection q shift. Surface: assess for specialty mattress or bed.</p> <p>Use bed cradle under linen. Use pillows between knees and boney prominences to avoid direct contact.</p>	<p>Very limited Surface: assess for specialty mattress or bed. Use bed cradle under linen.</p>	<p>Slightly limited</p>	<p>No limitation Encourage patient to report pain over boney prominences. No interventions required.</p>
Moisture	<p>Constantly Moist Skin assessment and inspection q shift. Use moisture barrier ointments (Protective barriers) Moisturize dry unbroken skin. Avoid hot water. Use mild soap and soft cloths. If diapers must be used, leave open as much as possible. Apply condom catheter if appropriate. Rectal tubes if appropriate</p>	<p>Moist Use moisture barrier ointments (Protective barriers) Moisturize dry unbroken skin. Avoid hot water. Use mild soap and soft cloths. Avoid use of diapers</p>	<p>Occasionally Moist Use moisture barrier ointments (Protective barriers) Moisturize dry unbroken skin. Avoid hot water. Use mild soap and soft cloths. Avoid use of diapers</p>	<p>Rarely Moist Encourage patient to use lotion to prevent skin cracks. Encourage patient to report any moisture problem (such as under breasts.) No interventions required.</p>
Activity *Use lifts and hover mats with positioning.	<p>Bed fast Skin assessment and inspection q shift. Position prone if appropriate Position with pillows to elevate pressure points off of the bed.</p>	<p>Chair fast Provide trapeze. Consider: postural alignment, weight distribution, balance, stability, and pressure relief when positioning individuals in chair or wheelchair. Provide appropriate seating surface. Instruct patient to reposition q 15-30 minutes when in chair. Pad boney prominences with foam wedges, rolled blankets or towels. Consider physical therapy consult (done by MD.)</p>	<p>Walks Occasionally Provide structured mobility plan. Consider physical therapy consult (done by MD.)</p>	<p>Walks Frequently Encourage ambulating outside the room at least bid. No interventions required.</p>
Mobility *Use lifts and hover mats with positioning.	<p>Completely Immobile Skin assessment and inspection q shift. Turn q 1-2 hours. Post turning schedule. Frequent small shifts of body weight.</p>	<p>Very Limited Turn q 2 hours. Post turning schedule.</p>	<p>Slightly Limited Ensure patient turns q 2 hours.</p>	<p>No Limitations Encourage ambulating outside the room at least bid. No interventions required.</p>
Nutrition	<p>Very Poor Skin assessment and inspection q shift. Nutrition Consult Offer Nutrition Supplements Monitor Nutritional Intake IF NPO for > 24 hours, discuss plan with MD</p>	<p>Probably Inadequate Nutrition Consult Offer Nutrition Supplements Monitor Nutritional Intake Small frequent meals IF NPO for > 24 hours, discuss plan with MD</p>	<p>Adequate Nutrition Consult (if patient has a wound.) Monitor nutritional intake Offer Nutrition Supplements (if patient has a wound.) Encourage family to bring favorite foods. IF NPO for > 24 hours, discuss plan with MD</p>	<p>Excellent Nutrition Consult (if patient has a wound.) Out of bed for all meals. Provide food choices. Offer Nutrition Supplements (if patient has a wound.) If NPO for > 24 hours, discuss plan with MD</p>
Friction & Shear *Use lifts and hover mats with positioning.	<p>Problem Skin assessment and inspection q shift. Minimum of 2 people + draw sheet to pull patient up in bed. Keep bed linens clean, dry, and wrinkle-free. Apply transparent dressing or elbow/heel protectors to intact skin over elbows and heels. Elevate head of bed as little as possible and for as little time as possible.</p>	<p>Potential Problem Keep bed linens clean, dry, and wrinkle-free. Avoid massaging pressure points. Apply transparent dressing or elbow/heel protectors to intact skin over elbows and heels.</p>	<p>No apparent problem Keep bed linens clean, dry, and wrinkle-free.</p>	

Accessibility of the Surgical Site

The surgical procedure and patient condition determine the position in which the patient is placed. To minimize trauma and operating time, the surgeon must have adequate exposure of the surgical site.

Accessibility for Anesthetic Administration

Incorporated in the plan, the anesthesia provider should be able to attach monitoring electrodes, administer the anesthetic and observe its effects, and maintain IV access. The patient's airway is of primary concern and must be patent and accessible at all times. The anesthesia provider needs to assess urinary output, blood loss, and irrigation used at all times. Consideration for visibility of measuring devices and drainage bags should be considered when positioning a patient.

Individual Positioning Considerations

If a patient is extremely obese (e.g. the patient occupies the width of the operating bed), his or her arms may be placed on armboards. Heavy-duty operating beds are available with side extenders to accommodate wide patients. Patients with arthritis or previous joint surgery may need special individual care due to limited range of motion in their joints. A patient who has cardiac problems or is obese may experience orthopnea or dyspnea when lying flat.

Pediatric patients, especially infants, require less operating bed length. Some surgeons like the foot portion of the bed lowered to decrease the length of the working surface for accessibility.

Body areas that need padding during positioning

See table 1:3

Body Areas That Need Padding During Positioning

Table 1:3

Supine Position	Prone	Lateral Position
Occiput	Anterior knees of kneeling patient	Face and ears
Heels	Face (forehead) and ears	Medial Knees
Elbows	Dorsum of foot to protect toes	Axilla
Sacrum	Breasts	Ankles and felt
	Genitalia	Arms

Positioners

Supine

- Headrest
- Pillow or other padding to place beneath patient's lower legs to reduce lower back strain.
- Padding for arm boards or arms if tucked. Use extra-long draw sheet for tucking patient's arms at sides.
- Padding for heels and foot board for steep reverse Trendelenburg's positioning.
- Padding for perineal post, if using fracture table.
- Roll or wedge to elevate patient's right flank if patient is pregnant or morbidly obese.

Prone Position

- Table-length mattress overlay. May need slightly shorter length if using accessory headrest parts.
- Prone headrest. May need extra padding if using accessory headrest adapter

- Chest rolls. Padding for arm boards (or arms if tucked), knees, and lower legs.
- Padding or positioning aid under patient's ankles to maintain foot extension.
- Padded table frames and adapters for spinal procedures (surgeons' preferences).

Lateral Position

- Table-length mattress overlay. Headrest and axillary roll.
- Padding for arm board for patient's dependent arm and padding for the upper arm. May support upper arm on padded frame or elevated padded arm board.
- Padding for opposing knees and heels. Roll or padded bean bag device to maintain or stabilize position.

Sitting Position

- Table-length mattress overlay. May need slightly shorter length if head fixation devices are attached to OR bed.
- Sitting headrest. Head fixation devices need all components and should be padded in area of patients contact.
- Padding for arms and extra-long draw sheet to assist with securing arms across patient's chest.
- Extra padding beneath buttocks if patient is thin
- Padding for lower legs and heels
- Padded foot board to prevent plantar flexion

Lithotomy Position

- Short mattress overlay if entire surgical procedure is performed in lithotomy position.
- Full-length mattress overlay if any portion of surgical procedure is performed supine or prone.
- May have to secure full-length mattress overlay to OR bed to prevent shifting when foot of OR bed is lowered.

- Headrest. Padding for arm boards and extra-long draw sheet if arms are tucked. Additional padding around hands.
- If patient's arms are tucked, the hands must not contact metal parts of OR bed or be located near bed break.
- Padding for ankle strap stirrups, knee crutch stirrups, and surface of stirrups in contact with patient's skin.

Position devices must be customized for each patient and surgical approach. The terms overlay, headrest, padding, and rolls refer to positioning devices that are composed of viscoelastic dry polymer, silicone gels, or high-density convoluted foam. Rolls composed of pressure-reducing materials that are able to support positioning needs are preferable to towel or rolled sheets.

Potential Complications due to positioning

See table 1:4

Potential Complications Due To Positioning

Table 1:4

*ROM: Range of Motion

Nerve Group/Area Affected And Symptoms	Potential Causes	Correct Position
Brachial Plexus: (Arm); Should to arm pain, Arm Flaccidity, numbness, limited ROM, Tenderness in supraclavicular area that involves entire arm.	Issues to the arm abducted more than 90 Degrees. Arm sags and is abducted and/or rotated externally.	Adduct patient's arm less than 90 degrees. Use padded arm boards with locking mechanisms. If arm is tucked by side pad as necessary and secure to avoid slipping off OR bed or mattress edges.
Shoulder; Shoulder pain	To shoulder are Braces to medial or lateral with arm abducted.	Place well-padded shoulder braces over acromioclavicular joints.
Neck and Head; partial sensation loss with spotty paralysis.	Allowing patient's head to rotate and/or dorsal extension and lateral flexation of patients head to opposite side.	Do not allow patient's head to rotate. Secure patients head in neutral position as much as possible if using tape cover skin first.
	Dependent shoulder and arm directly under patient's rib cage with all upper body weight on them.	Place roll slightly under patient's axilla to support upper rib cage.
	Arms severely abducted and anteriorly flexed more than 90 degrees.	Abduct patient's arms minimally with flexion less than 90 degrees.
Suprascapular nerve: (Shoulder) Pail localizes to posterior and lateral aspects of the affected shoulder	Forced abduction of arm across the chest. Facing downside arm ventrally and medially with shoulder circumducted.	Do not forcefully abduct or tightly secure patient's arm across chest. Stabilize patient placed in lateral position.
Circumflex nerve: (Arm) inability to abduct arm, sensation loss over upper half of lateral aspect of affected arm	Arms abducted 90 degrees that are allowed to press against the vertical bars of anesthesia screen.	Place sufficient padding against the patient's arm and the anesthesia screen of retractor posts.
Radial nerve: (Arm/Wrist) weak grip on ulnar side of fist or inability to oppose or abduct fifth finger. Weak flexion of fourth and fifth fingers.	Arm extended on arm board with forearm pronated. Arms folded too tightly over abdomen or chest, with elbows flexed greater that 90 degrees.	Supinate patient's forearms. Do not forcefully restrain arms. Flex elbow 90 degrees or less.
Impaired adduction/abduction of medial four digits.	Arms secured too tightly at side with inadequate padding at elbow.	Place sufficient padding at elbows.
"Claw-Like" hand	Elbows were allowed to slip off mattress or edge of OR bed.	Extend draw sheet above the elbows and tuck between patient and the mattress of OR bed.
Obturator: weakness or paralysis of adductors of the thigh.	Extreme flexion of the thigh at the hip.	Minimize flexion of patient's hip
Sciatic Parathesia: If the muscles below the knees.	Emaciated patient supine or sitting on inadequately padded OR bed.	Generously pad OR bed beneath patient's buttocks.
Numbness: of lateral half of calf and most of foot.	Legs positioned straight while in sitting position.	Flex the OR bed t the patient's knees.