Positioning And The Surgical Robot

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Here's how to deal with the special requirements of the surgical robotics experience.

One of the most important discussions surrounding patient positioning today revolves around the area of robotic-assisted laparoscopy. Having observed many GYN and urologic robotic procedures, I became painfully aware that the unique nature of the surgical robot has created unintended consequences with regards to patient positioning. Since the earliest days of the robot, there has been a substantial void between real-time positioning requirements, existing patient positioning standards and guidelines, as well as the availability of new generation, robot-compatible accessories.

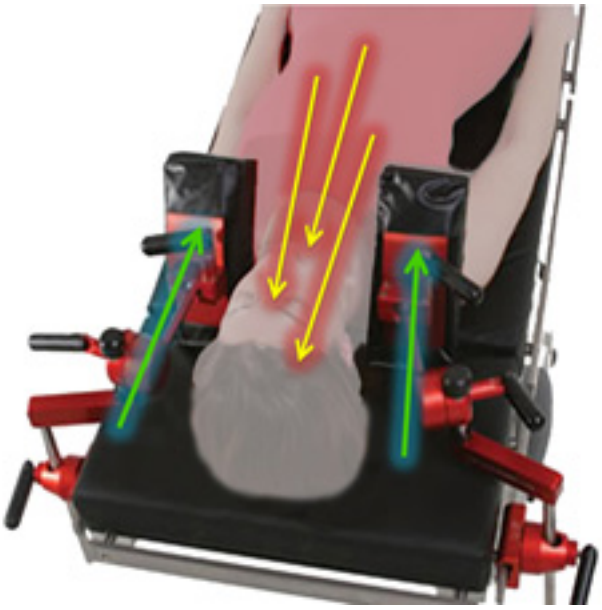
In this article, I will identify some of the “unintended positioning related consequences” and shed light on the strengths and limitations of many of the contemporary positioning accessories currently being used for positioning patients during robotic procedures. The primary focus will be on Trendelenburg and upper extremity patient restraints.

Trendelenburg Restraints
Current positioning principals and guidelines apply to traditional laparoscopy. In robotic surgery, there exist certain positioning requirements that make a number of the guidelines and recommended Trendelenburg restraint devices inappropriate.

It is a fact that contemporary Trendelenburg restraints permit patients to slide during the course of traditional MIS and open surgical procedures requiring the Trendelenburg position. I have been told that it is not unusual for patients to slide

"just a little bit" (equating from one inch to as many as six inches) on the table. The sliding occurs quite slowly, gradually, and commonly. It becomes obvious only at the end of the procedure after removal of drapes. It most often presents itself as a noticeable reduction of leg flexion when utilizing booted stirrups. The concern for patient risk due to sliding a few inches when in Trendelenburg appears to have been relatively low. However, this isn't so with robotic procedures. Sliding during robotic surgery places the patient at serious risk for injury.

Extreme Trendelenburg and the Effects of Sliding During Robotic Surgery



The effects of patients sliding while in Trendelenburg cannot be ignored, as the robot is not programmed to detect if a patient is moving or sliding on the table.

Patients sliding on the table during robotic surgery is becoming recognized globally as a serious patient positioning risk. The robot is incapable of adjusting to any variations in the patient's position on the table. When a patient slides, even just one half of an inch, the robotic arms, instruments, and trocars maintain their fixed location as programmed. Ultimately they become the primary restraint for the patient. This has been ironically referred to as "the meat hook" restraint technique. Analysis of the literature suggests that patient injuries from sliding on the table during robotic procedures will present as severe and prolonged post-op pain, bruising, or even necrosis at the primary port sites.

The History of Robotic Trendelenburg Positioners

A number of positioning concepts were adopted or developed by early robotic adopters and passed along by example or by practice to others as robotic surgery gained favor.

• *Shoulder Braces* – These devices are very effective in anchoring the patient on the table. They are also generally avoided. It is well documented in the literature that shoulder braces are causal to brachial plexus injury. Martin, in his text entitled "Positioning in Anesthesia and Surgery," describes the combination of gravity and patient weight forcing or "funneling" the patient's mass between the braces. This distorts the clavicle, which places direct pressure on the brachial plexus. Martin also

states clearly that extra padding does not reduce patient risk or reduce the cause of brachial plexus injury.

• *Tape and Foam* – Early robotic restraint concepts, still used by many hospitals, include interesting “homemade” designs for patient restraint. In an attempt to fix the patient onto the table, these techniques were often created based on theory, conjecture, and the availability of large quantities of tape and foam. Several of the techniques restrict respiration by crossing adhesive bands over the chest and under the table, sticking them to the table rails.

• *Anatomical Concavities* – Restraints utilizing the patient’s natural, anatomical concavities were first described in 1956 by the English anesthesiologist, Dr.Langton Hewer. He described his successful experiences utilizing the concavities of the body (nape of the neck, small of the back, behind the heels), each of which contributed to the stabilization of the patient on the table. This technique eliminated the need for straps or bracing. This concept was updated and commercialized for the first time in 2006.

Arm Restraint Devices for Robotics

Contrary to AORN guidelines tucking arms has become the standard for performing robotic procedures.

AORN guidelines clearly state the following: “Unless necessary for surgical reasons, the patient’s arms should not be tucked at his or her sides when in the supine position. Patient risks associated with tucking includes interference with physiologic monitoring (e.g.,blood pressure monitoring, arterial catheter monitoring) and the inability to resuscitate during an emergency due to unrecognized IV infiltration in the tucked arm. There is also an increased risk for the patient to develop compartment syndrome in the upper extremity.”

Contemporary toboggan devices are effective in cradling the arms for MIS procedures. However, they have proven to be impractical for use during robotic surgery, as they often clash with the robot arms or interfere with the assistant.

Arm restraint devices are available that were designed specifically for robotic surgery. They meet or exceed AORN guidelines while safely restraining arms and allowing easy access to IV lines. Several do not interfere with the assistant or clash with the robotic arm.

Summary
These suggestions are the result of conversations and interviews with nurses, surgeons, and anesthesiologists and my personal experiences observing robotics procedures. In my opinion, the ideal robotic positioning "system" should include:
• Split Leg accessory for lower extremity support
• Anatomically-designed multi-positional split leg accessories should replace higher profile stirrups. They can increase operative space for robotic arms and further reduce the potential for peroneal nerve injury
• Trendelenburg restraint that anchors the patient in place
• The device technology must completely eliminate any risk of patient sliding
• It cannot utilize shoulder braces as they encourage skeletal distortion
• It must not incorporate crossing chest straps to assure proper respiration
• Arm restraints should provide a safe environment for the arm without tucking
• Arms should be securely cradled against the patient with very little compression
• The restraint should have allow profile to avoid clashing with the robot arms
• It should be unobtrusive to surgeons and assistants
• It must provide immediate and easy anesthesia access
• It should easily accommodate high BMI patients
• Table mattress should be the highest quality pressure relief patient surface available
• The mattress should fully conform to the patient in order to reduce shear and lower the risk of pressure injury

Developing clinical standards for patient positioning for robotic surgical procedures is an important goal that needs to be addressed and reached immediately.

It is well past time that we question common theory on positioning patients who are being subjected to extreme postures and unusual circumstances. It is obvious to me that the classic positioning rules and current published AORN standards of care for patient positioning in extreme postures were not designed for the unique environment and the special requirements of the surgical robotics experience.

Mr. Dan Allen is a published author and speaker recognized as an authority on patient positioning and pressure management in the operating room. He has been involved in the development, pioneering, and marketing of innovative surgical table accessory devices since 1978 and may be best known as the inventor of the Allen Stirrup and many other innovative patient positioning devices. His disclosure includes being a founding partner of Medicus Surgical and Nursing CE Portal.

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