Journal of Visceral Surgery (2010) 147, e227—e232

BASIC MANEUVER

Patient positioning in laparoscopic surgery: Tricks and tips

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Introduction

By the very fact that a patient is positioned on the operation table, he or she runs a risk of complications. Patient positioning is an integral part of the surgical gesture and the surgical and anesthetic teams have the role and responsibility of assuring that positioning is optimal both for surgical efficacity and for patient safety. Laparoscopic surgery has been associated with specific complications secondary to extreme patient positions and also to prolonged operative times (the so-called ''learning curve''). The goal of this article is to define the strategies of patient positioning.

Operative injuries can be of three types:

- nerve injury due to compression or stretching;
- rhabdomyolysis;
- compartment syndromes.

To study these iatrogenic complications, the American Society of Anesthesiologists used registries of Insurance company claims. Thus the ''American Society of Anesthesiologists Closed Claims Project'' [1] collected more than 4000 claims from 35 insurance companies. Nerve complications represented 16% of the complaints. Of these, 28% involved the ulnar nerve, 20% involved the brachial plexus, 16% the lumbosacral plexus while 5% were injuries of the sciatic nerve or branches thereof. Lumbosacral and spinal cord lesions clearly occur more frequently during spinal anesthesia [2] and are more related to complications of anesthesia technique than to the method of patient positioning.

Possible mechanisms include stretching, compression and ischemia. These mechanisms can unmask or aggravate a pre-existing disease (diabetic neuropathy, etc.). Thin patients are more vulnerable because the cushion of subcutaneous fat that protects the nerves from compression is reduced. This is particularly true for ulnar nerve compression. In general, these lesions are not permanent but postinjury recovery may require as much as a year.

The purpose of this article is to describe the most frequent complications, their mechanisms and the means to prevent them.

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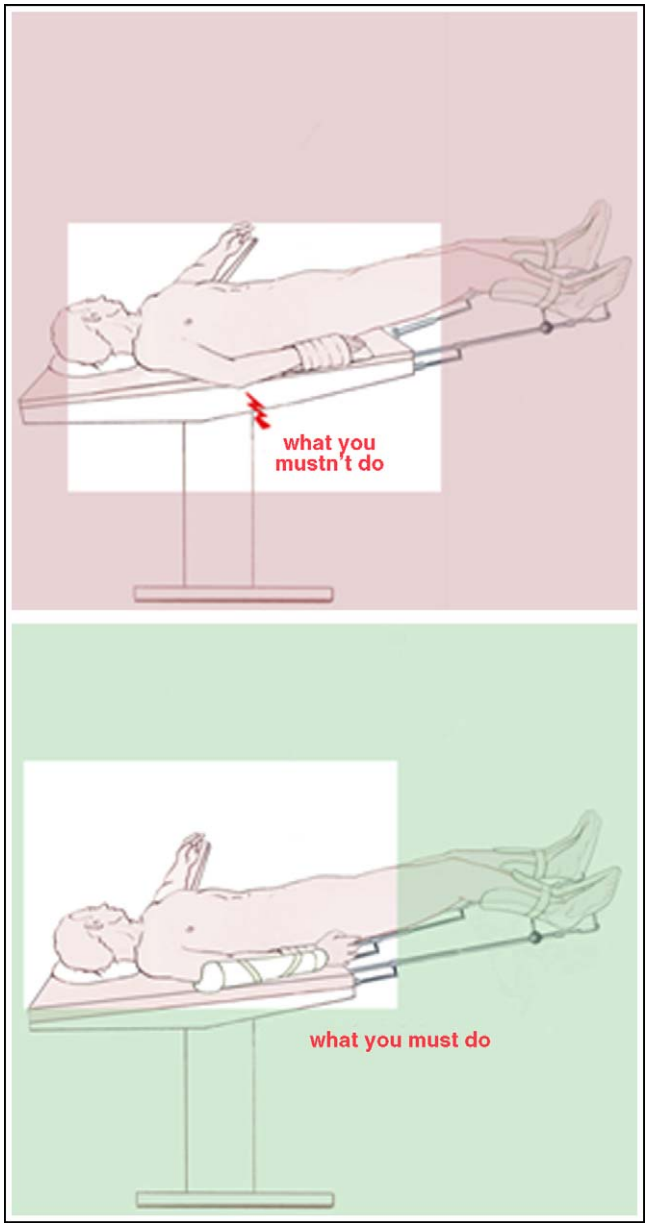
1878-7886/$ — see front matter
doi:10.1016/j.jviscsurg.2010.07.010

1 Ulnar nerve injury

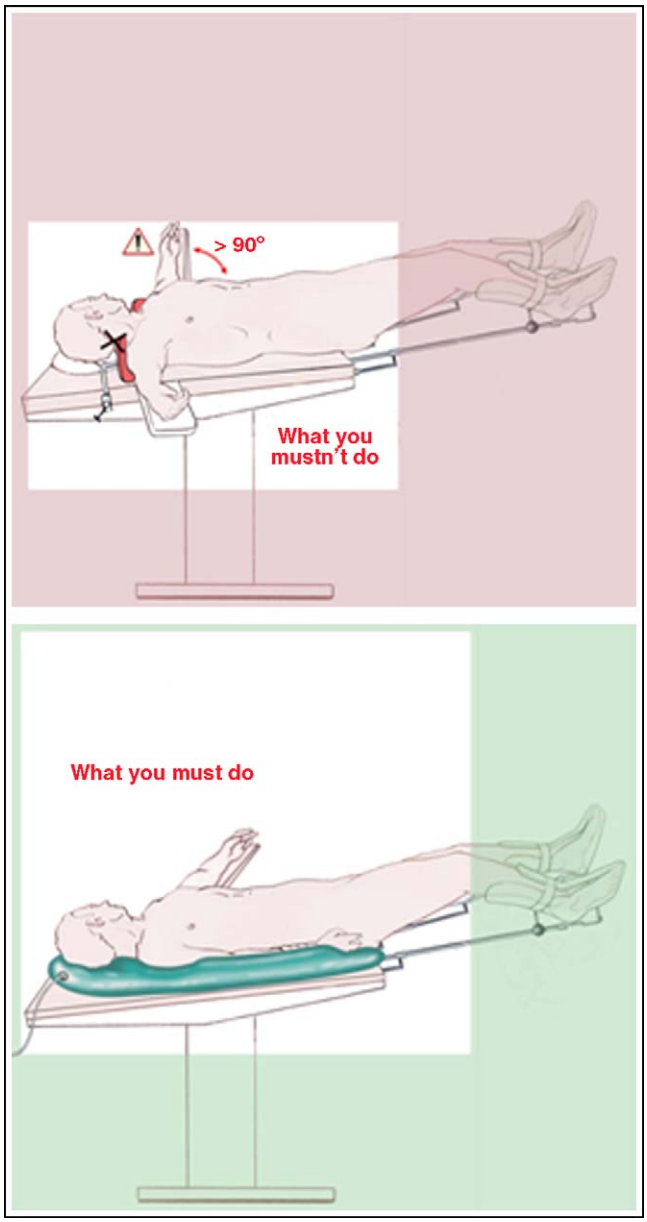
Ulnar neuropathy typically causes hypoesthesia of the fourth and fifth fingers. It may also result in claw hand, thumb adduction palsy, and muscle atrophy of the hypothenar eminence and interosseous muscles.

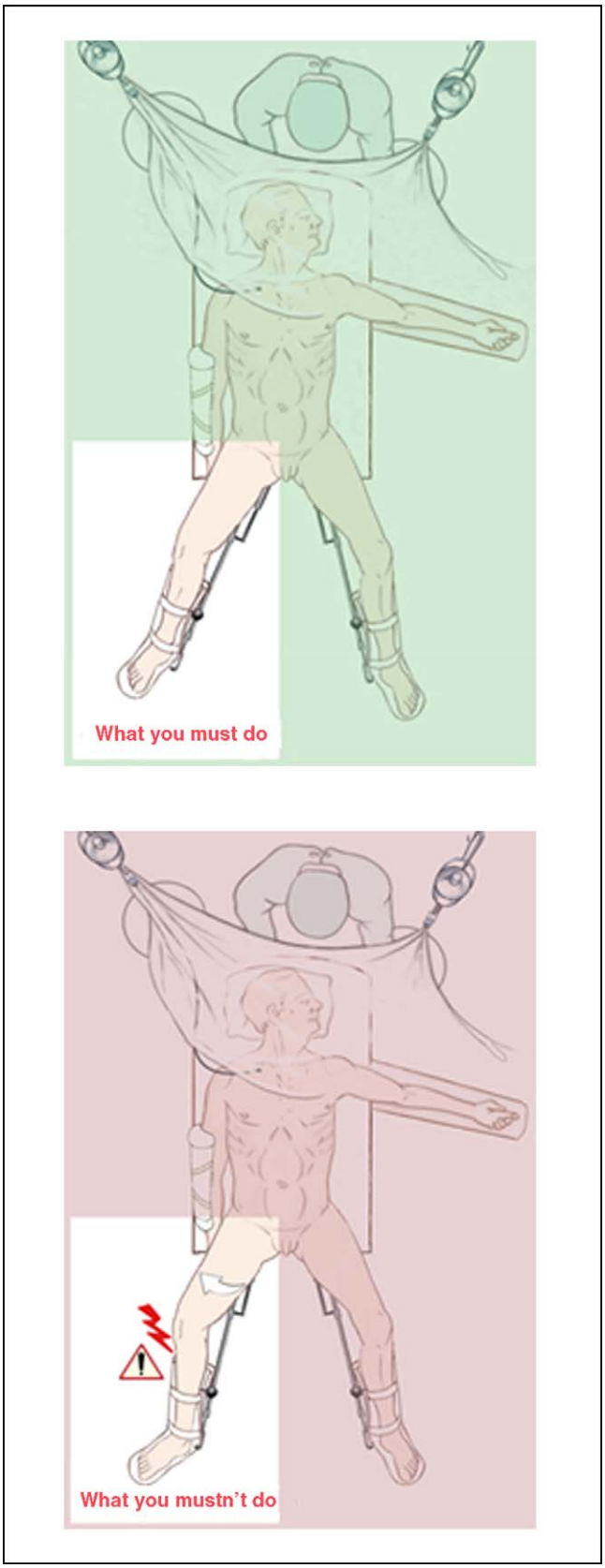
The mechanisms implicated in ulnar nerve injury are variable: squeezing effect of the gutter armrest, extrinsic compression or simply exacerbation of pre-existing lesions. Compression is the main mechanism, especially when the upper extremity is placed in pronation. Occasionally, subclinical involvement can become apparent postoperatively.

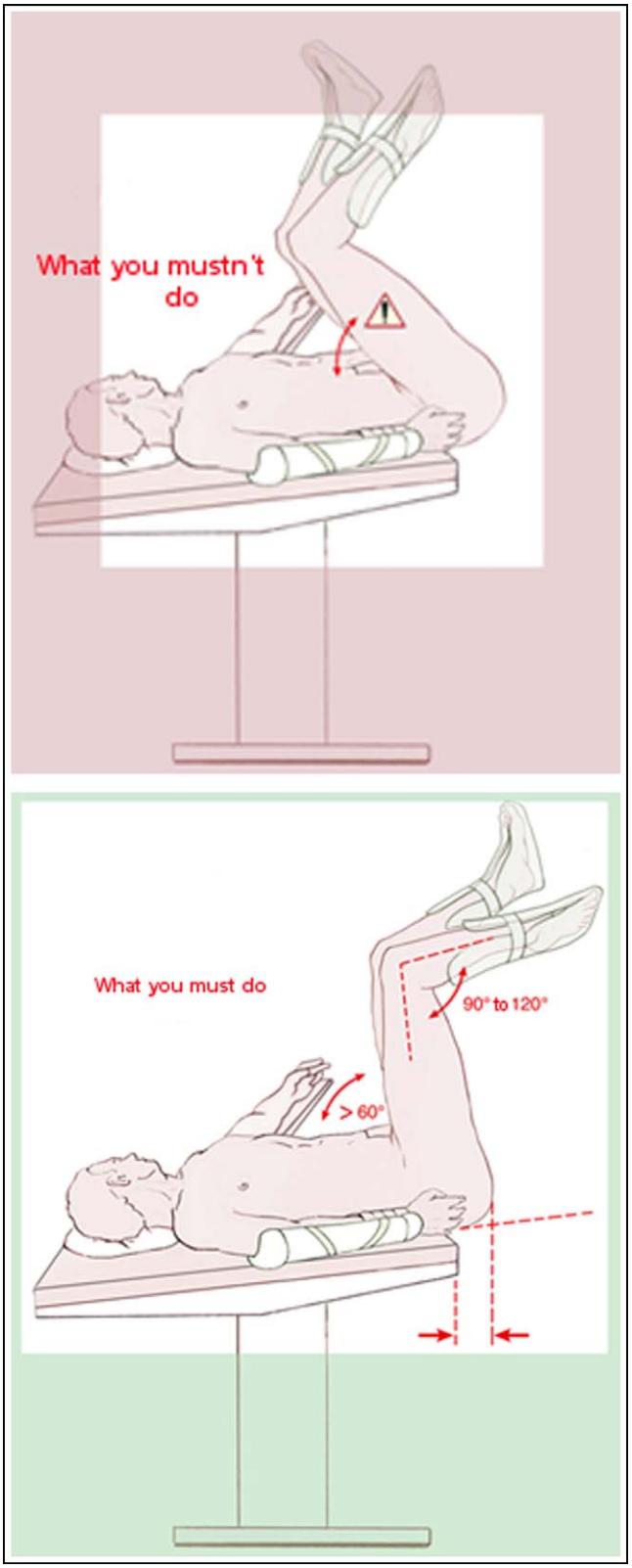


2 Brachial plexus injury

Brachial plexus injury leads to a sensory deficit in the shoulder area and motor impairment of upper arm abduction. Stretching is the principal mechanism of these lesions and the risk is maximal when the arm is abducted 90° and extended 30°. This risk is increased in thin patients and if both arms are abducted/extended. When the patient is placed in Trendelenburg position in association with the use of shoulder braces, exaggerated abduction, or neck hyperextension, this favors brachial plexus injury; the shoulder supports press directly against the clavicle and scapula while gravity abducts the humerus. Moreover, the association of Trendelenburg position with the table rolled laterally can favor sliding of the patient, enhancing the possibility of compression, even when the arm is placed along the patient's side. Shoulder braces should be prohibited. Use of vacuum ''beanbag'' mattresses should help to avoid such complications and facilitate extreme positioning with less risk.







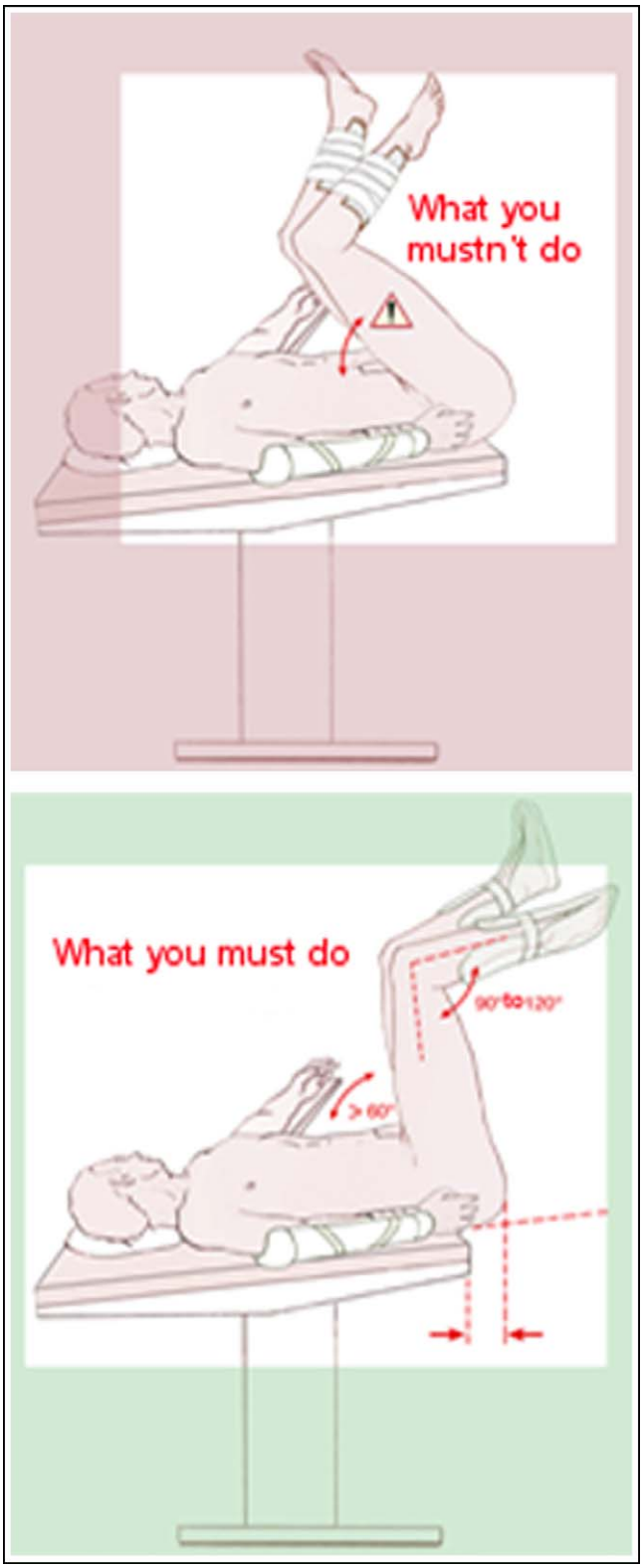
3 Lower limb injury

More than 80% of lower limb neuropathies are related to peroneal nerve injury. These lesions are usually caused by external compression on the nerve against the head of the fibula; injury results in foot drop along with loss of sensation over the lateral aspects of the leg and dorsum of the foot. Positioning the patient in leg holders without heel support and use of wraps to maintain the leg on leg rests enhance compression injuries, whereas placing

the lower limb in boot leg holders with heel support alleviates pressure on the head of fibula, as long as the leg is not in external rotation (a).
Injury to the sciatic nerve (15%) is seen in excessive hip flexion in the lithotomy position; this is exacerbated when the knees are only slightly flexed. Sciatic neuropathy results in loss of flexion and extension of the foot along with loss of sensation on the anterior and posterior aspects of the legs and feet.
Femoral neuropathy (4%), on the other hand, is more often due to mechanical trauma caused by retractors than to patient positioning. Thin patients and smokers are at increased risk for this complication. The more time spent in the lithotomy position, the greater the risk of sciatic nerve injury: for every hour in this position, the risk increases 100-fold.

4 Rhabdomyolysis and leg compartment syndrome

Rhabdomyolysis, most commonly seen in bariatric surgery where the frequency can be as high as 25%, is not directly related to patient position. The risk factors include: operative duration longer than four hours, body mass index greater than 60 (super obese), diabetes, and ASA scores greater than 2. On the other hand, compartment syndromes have been described in normal weight patients during operations performed in the lithotomy position. Several of these have led to severe nerve sequelae or even to death-related metabolic disorders.
Compartment syndromes can be explained by muscular ischemia and increased pressure in the leg compartments due to the combination of low venous return (iliac vein compression secondary to excessive flexion of the thigh over the trunk) and decreased perfusion (elevation of lower limbs).
Predisposing factors include operations lasting more than 4 hours, leg flexion over the trunk, inadequate padding of the operation table, and excessive dorsiflexion of the foot. Spinal anesthesia seems to enhance distal hypoperfusion.



ESSENTIAL POINTS

- Minimize the duration of the operation and time spent in the lithotomy position.
- Limit the risk of peroneal neuropathy: the combined abduction of the lower limbs should not exceed 90°, minimize lateral hip rotation, and position the legs in boots, maintaining the weight on the heels.
- Limit the risk of brachial plexus neuropathy and prevent the patient from sliding up the table when in the Trendelenburg position by the use of a vacuum ''beanbag'' mattress; if this is not available, leave the buttocks overhanging the end of the table. Shoulder holders should never be used, arms should never be abducted beyond 90°, and the head should be maintained in a neutral position — not turned to either side.
- Limit ulnar neuropathy by padding the gutter arm rest, avoiding pronation and placing the arm in a neutral position with the hand flat against the lateral aspect of the thigh, wrapped with gel pads, and maintained at the patient's side by a sheet wrapped around the arm and tucked beneath the patient.
- Limit the risk of leg compartment syndrome by avoiding thigh flexion greater than 130° and maintain knee flexion between 90 and 120°. Avoid leg wrapping in favor of boot supports for the legs.
- Avoid finger compression. Protect the hand with gel padding at all pressure points. The assistant should avoid leaning against the thighs when standing between the legs. Be sure that the rigid parts of the operating table are adequately padded.

Conflict of interest statement

The authors have not declared any conflict of interest.

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