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6.1 Introduction

Proper patient positioning for upper cervical surgery is crucial for the correct execution of the surgical procedure and, if not applied correctly, can give rise to dangerous complications. We can compare the surgical patient positioning to the alignment of military troops before a battle: if strategically correct, it can influence the result, if applied improperly it can lead to disaster.

Key to success are the several adjustments that can be made during surgery and that must be taken into account beforehand. Neuromonitoring, navigation and fluoroscopy can be difficult to plan in such a small anatomic area i.e. everything should be planned and checked before. As a rule, these adjustments should be carried out preoperatively, whilst the patient is still awake, verifying the possible ranges of neck hyperflexion–hyperextension to simulate what will be [1, 2].

Planning the position of the Mayfield's blocks before draping enables us to adjust the neck flexion during surgery while fixing the patient safely to the table, making possible to tilt the table safely.

Supine and prone positions are the most commonly used for the anterior transoral approach and posterior fusion/decompression procedures, respectively. Lateral positioning is also used when a combined anterior-posterior approach is required, minimizing the risk of a double positioning procedure and reducing operating times [3].

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6.2 Supine Position

Supine position is mainly used for anterior endoscopic endonasal or transoral approaches to the CVJ. Positioning is similar to the one used for anterior cervical discectomy (ACDF). Usually a flexible armoured nasotracheal tube is used. Retractors and endoscopic holder are fixed to the table contralateral to the surgeon, as well as the monitors (Fig. 6.1).

6.2.1 The Body

The body remains in dorsal decubitus. This is the easiest positioning, and attention should be focused in fixing the patient safely to the table and to elevate the legs slightly ($7\text{--}10^\circ$) to allow a correct venous backflow to the heart [4].

The so-called lawn chair (contoured) position is a variation of the horizontal position adding a 15° flexion at the trunk and hips. A blanket or soft (gel) pillow can be placed under the knees to keep them slightly flexed. This position provides more physiological positioning of the lumbar spine, hips, and knees. The other advantages of the lawn chair position include a slight head elevation improving venous drainage from the brain, and a slight elevation of the legs, that improves venous return to the heart [5]. The head-up tilt or reverse Trendelenburg position usually involves a $10\text{--}15^\circ$ repositioning from the horizontal axis in order to provide optimal venous drainage from the brain [6].

6.2.2 The Head

In case of concomitant spinal stenosis and cervical cord compression, the patient is usually transferred to theatre with a Philadelphia collar that is held in place during intubation, so that the anaesthetist can safely perform awake fibre-optic intubation.

Fig. 6.1 Supine positioning with cervical and shoulders taping



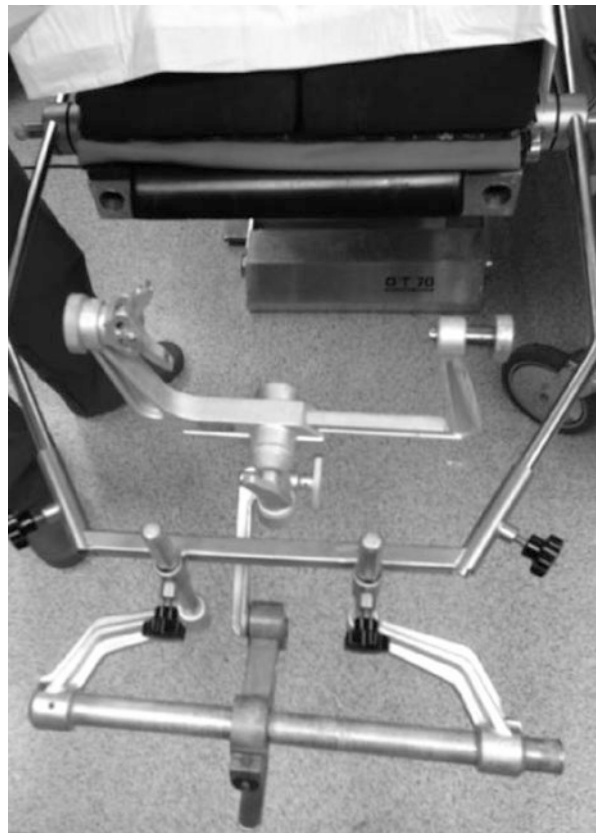
With regards to the head position in supine patients, we have two options.

In the first one, the patient's head is extended backward and downward with the surgeon standing at the back of it. The microscope will be at 90° on the operative field. Head extension will allow a wider exposure of the skull base. When instability and/or potentially cord compressing lesions are present, the head will be initially positioned in neutral position, and only once satisfactory decompression is achieved, the surgeon will be able to change the degrees of head extension. When anterior instrumentation is required, it is mandatory to achieving neutral position before fixing the spine.

The second option is mainly used in endoscopic assisted surgery, with the surgeon facing the patient [7]. In this case the head is placed on a horseshoe headrest and may not be fixed allowing multiple minimal adjustments intraoperatively.

Whichever of these positions is chosen, care must be taken in planning in advance the position of the fluoroscopic arm, should it be used during surgery, as the arm of the Mayfield clamp might interfere with AP views. To avoid this, the patient should be positioned on a Jackson table. If a Jackson table is not available, the head clamp could be secured on the arch used for sitting position. The arch is secured anteriorly with the head clamp in the centre (Fig. 6.2).

Fig. 6.2 Head clamp positioning when fluoroscopic AP projections are required: note that the area under the patient's neck is completely free of metal structures that could interfere with the imaging



Even if the supine position is the most physiological one, it is not risk free. Peripheral nerve compression injuries are the most common complications of this position although are less frequent than in the prone one. Other complications of the supine position include pressure alopecia (for long procedures), backache, and tissue ischemia [8].

6.3 The Prone Position

The so-called Concorde or landing Concorde position (Fig. 6.3) is the most common prone position for posterior or posterolateral approaches to the CVJ. It is used for posterolateral approaches to the CVJ. The principle is that the head is flexed to better expose the C0–C2 region, and elevated higher than the right cardiac atrium to achieve better venous return.

6.3.1 The Body

The patient is intubated in supine position and then carefully turned on a square soft pillow to allow release of the abdominal pressure both arms are secured along the body to allow secure table tilting. Shoulders are gently pulled downwards with tape to visualize C7 vertebral body during intraoperative lateral X-rays when necessary. When taping care must be paid to avoid excessive stretching of the brachial plexus. Knees are flexed with the feet slightly elevated to obtain a better venous flow gradient. A pneumatic leg compression machine or alternatively leg wrapping with compression bandages are also applied.

6.3.2 The Head

For the posterior approach, neck flexion is helpful to obtain the proper trajectory for drills and screws whose direction is almost parallel to the bone surface of the spine. The so-called military tuck position is often required in CVJ surgery, in order to increase the surgical exposure between the occiput and C2. The patient is positioned with the head put in the Mayfield clamp. Mayfield pins are positioned in a way to keep the posterior fossa area completely free.

Fig. 6.3 Author's illustration of Concorde position



Some degrees (20°–30°) of anti-Trendelenburg are applied to the cranial part of the table in order to raise the head and to facilitate venous outflow, which is extremely important in order to avoid eye complication and perivertebral venous plexus bleeding. In this way we can obtain an operative site that is parallel to the floor [6].

When draping, one should consider the possibility of extra stab incisions, which are often necessary to keep the right trajectory of drill and screws.

If a Jackson table is used, the head clamp could be directly connected to the table.

Specific complications include necrosis of the chin and an obstruction of cerebral venous outflow.

6.4 Lateral Position

Lateral position can be used for one stage anterior transoral decompression surgery and posterior fixation. The rationale is to avoid repositioning and redraping the patient after the decompression and before performing stabilization. With the head secured in the Mayfield clamp, the patient's neck is absolutely stable throughout the whole surgery. The difficulty is to provide a position that can also be comfortable for the surgeon and for the instrumentation [3, 9]. Lateral positioning leads to gravitational changes in the ventilation–perfusion relationship in the lung. Lung tissue above 18 cm from bed level is not perfused. During general anaesthesia and positive pressure ventilation, the non-dependent lung zones are ventilated better with respect to the dependent zones, worsening ventilation–perfusion mismatch.

6.4.1 Park Bench Position

The Park Bench is a modification of the lateral position. It gives the surgeon a more comfortable operative position with better access to the posterior fossa, as compared to the lateral position. The upper arm is positioned along the lateral trunk and the upper shoulder is taped towards the table. Special attention is required for positioning the patient's dependent (lower) arm because of the potential danger of axillary artery compression and brachial plexus injury [2, 10]. The dependent arm can be positioned in hanging or ventral position and may be rested on a low padded arm board, inserted between the table and head fixator. Alternatively, the forearm can be hung on a pillow and towels wrapped over the arm and forearm. The shoulder should be abducted, and the elbow flexed. An axillary roll, inflatable pillow or a gel pad should be placed under the upper chest (not directly in the axilla) in order to take pressure off the dependent shoulder and prevent arm ischemia, brachial plexus injury and compartment syndrome. It is also critical to support the patient's head with a pillow or gel pad to minimize angulation of the cervical spine, which can be achieved with the simultaneous inflation of both inflatable pillows under head and chest [6].

The lower extremities should be slightly flexed, and a pillow should be placed between the legs (particularly the knees). Reverse Trendelenburg and marked flexion of the legs at hips and knees should be avoided, as it can lead to lower extremity venous stasis and decrease of venous return to the heart. Leg wrapping with compression bandages can be used to prevent venous pooling [1].

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