(54) Title: TURN-TABLE FOR SPINAL SURGERY IN THE KNEE-ELBOW POSITION

(57) Abstract

Turnable operating table device for operations in the knee-elbow position comprising the combination: a) a vertical extending support device (1), b) a horizontal extending device (4) fixed to this carrying an operating table part (7) having c) fixation means (11, 12, 13, 14, 15, 16, 17, 18, 19) for a patient. All these (1, 4, 7) are turnable about their longitudinal axes, and it is essential to the invention that the table (7) may be rotated at least 180° in the horizontal and 360° in the vertical plane.
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TURN-TABLE FOR SPINAL SURGERY IN THE KNEE-ELBOW POSITION.

The present invention relates to a turnable operating table device for spinal surgery with the patient in the knee-elbow-chest position.

Several kinds of tables and devices have been developed which may be rotated around different axes to bring the patient into the most suitable position. None of the prior art devices are particularly suited for spinal surgery, and particularly not if the patient in a deeply anaesthetised condition has to be lifted on to the operating table and then placed in the knee-elbow position. (Spine, volume 8, no.8, (1983), page 897-900), N. Eie, T. Solgaard and H. Kleppe. In Norway the knee-elbow position was introduced at Ullevaal Hospital by Kristian Kristiansen during the end of the 1940'ies and has subsequent till the end of 1983 been applied to more than 3000 patients.

The advantages of the knee-elbow position are:

1. The lumbar lordosis is straightened out, the rear space between the vertebrae is increased and the approach to the intra spinal space is thereby considerably improved. In addition both iliac crests are prominating, which is essential for taking bone-chips with ease from these when posterior spinal fusion is to be carried out.

2. The approach to the facets on both sides also becomes very good.

3. Because the abdomen is freely suspended and relaxed, the intra-abdominal and venous pressures are as low as possible. The respiration (breathing) and venous back-flow are free. Consequently the bleeding from the wound is minimal.

4. Follow up studies of 2690 patients operated upon for lumbar disc herniations in the knee-elbow position at Ullevaal Hospital during the period 1950 to 1981 show that
neither occurrence of death nor other serious lasting complications have occurred. The results were satisfying in 70-80% of the non-fused and in more than 90% of the fused patients after 10-30 years of observation. (Spine, ibid).

The main disadvantage of the knee-elbow position is so far that the patient has been lifted into position on the operating table in a narcotic or deeply unconscious condition. This means that the patient is without any "defence musculare" or reflectoric muscular protection during a rather heavy manoeuvre. This may result in undesirable displacements of intra spinal structures of the sick area and perhaps causing damage to the nerve roots even if the lifting manoeuvre is carried out by a trained team of sufficient number of strong individuals. The performance of this procedure is in other words both resource demanding and not without risk.

The patient should preferably be in an alert state and substantially by own means be able to get into the knee-elbow position on the operating table. When feeling comfortable in this position, the person is "locked" to the table by means of side supporters and a back shield. Then the rotation of a completely awake patient can be carried out and a proper position achieved for intubation and general anaesthesia being performed by the anesthetist. When the anaesthesia is executed, the table and patient can be turned back to the position for operation with minimum risks for injurious movements of the spine. The back-shield is removed and the operation can start.

According to the present invention this may be achieved by a turnable operating table device comprising the combination of:

a. a vertical extending support device,
b. a horizontally extending elongated turnable device - at least partially - around its horizontally extending axes in its direction of length, extending perpendicularly through a fixation of said abovementioned perpendicular support device, and
c. a turnable operating-table part having fixation means for a patient.

which operating table part is supported by the turnable horizontal elongated device by fixation means making the table-part rotatable at least 180° around an axis which approximately extends in the horizontal plane through a patient from the head to foot when this is fixed to the "table" part, and which axis is perpendicular to the horizontal extending supporting elongated turnable axis device.

Suitably the vertical extending support device may be designed as a pillar. Two equal support devices can preferably also be screwed in to the floor (possibly the roof), one in the anaesthesia-room and another in the operating room. By means of a particular docking system the operating table part with the patient thereon is detached from the support device and conveyed on a roller table or any other convey device from the anaesthesia room into the operating room and docked to the support device in the operating room, - the vertical extending support device can optionally be fixed to a mobile support, the patient being fixed to the operating table part being conveyable from one room to another, f.i. from an anaesthesia room to the operating room.

The horizontal extending elongated device carrying the operating table part is preferably designed as a beam.

To place the patient in the desired height above the floor the horizontally extending device carrying the table is secured to be raised and lowered on the vertical extending support device. Suitably the fixation to be raised and lowered will be connected to motorized or pneumatic energetic means.

Suitably the fixation means of the operating table part to the horizontal support device comprize a shaft extending perpendicularly in the horizontal plane through the last mentioned. This can suitably be achieved by the fixation means of the operating table part to the horizontal extending support device
being designed in the principle similar to the one half of a
universal joint. The operating table desk part face may
suitably have a "U"-shaped profile with feet extending upwards
or downwards or being designed as a square tube.

The following objects are satisfied and benefits achieved by
the turnable operating table device according to the invention:

1. Rotation of the table with a patient fixed about 180°
   around an axis approximately through the patient from head
to foot in the horizontal plane.

2. Rotation of the operating table with the patient fixed
   360° in the vertical plane.

3. Raising and lowering the operating table with a patient
   fixed as required (30-40 cm).

4. Turning the operating table in the horizontal plane
   approximately 160°.

5. The turn-table device may also be used for surgery of
   other regions than the lumbar spine e.g. of the neck and
   brain. Further it can be used for X-ray examinations,
   spinal anaesthesia etc. This is possible by means of a
   special docking system (= fastening and detaching system)
   of the device allowing the part of the turnable which is
   specially designed for spinal surgery to be detached by a
   single manipulation and substituted by a component suitable
   for other fields of surgery.

The invention is to be further elucidated by the following
detailed description referring to the appending drawings.

Fig. 1 shows a turnable operating table device of the invention
as a side-view, and Fig. 1A a variation of a component of this.
Fig. 2 shows the same operating table device in a frontal view
(i.e. turned 90° in relation to fig. 1) with a patient in left
side view locked to the operating table part (7) having support means not being shown on fig.1.

Fig. 3 shows in perspective view a variation of the same turn-table device as of fig.2, wherein some details are varied.

Fig. 4 illustrates the turnable operating table device of fig.1 simplified with the patient fixed in a rear view and with his back upwards.

Fig. 5 is a corresponding view to fig.4, but with the patient with his back down and with the back support (shield) (19) secured for support.

Fig. 6 illustrates the turnable operating table device corresponding to fig.1, but as a conveyable variation.

Fig. 7 illustrates a device corresponding to fig. 1 and fig. 6 seen from above with a fixable and detachable operating table part (7).

Fig. 1 illustrates a device to carry a docked patient, which device comprise a vertical pillar (1) standing in a socket (2).

The pillar may be raised and lowered by a raising means (3). A support beam (4) is secured to the pillar (1) by a strong compact bar or tube (5) penetrating the pillar (1) and being rotatable in the horizontal plane by means of a motor (6).

At the other end of the support beam (4) a mobile but lockable operating table part (7) is secured which may be turned about an underlying shaft (8) penetrating the support beam (4). By means of the indicated motor (9) the operating table part can thus be turned at least 180° about the shaft (8) the table itself arriving below the support beam (4). Due to the support strength the operating table (7) may be reinforced by providing the table with a profile, e.g. U-profile directed downwards on fig.1 and upwards on fig. 1A.
On fig. 2 the table part (7) is illustrated in closer details with the patient (10). The patient has to be supported and kept in position by means of adjustable leg supports (11) having securing means (12) adjustable underarm support (13) having securing means (14), fore-head support (15) chest support (16), side support (17) and seat support (18). A back support (19) may be secured between the forehead support (15) and seat support (18) with connections to the side supports (17) to support the patient when he is turned approximately 180° about the shaft (8) of fig.1.

Fig. 3 illustrates a variation of embodiments of the same device. However the support beam (4) is here divided into two parts, and the outer part remote to the pillar (1) is turnable about a tube (5) in the horizontal plane, which tube has an equivalent function to the tube of fig.1. The operating table part itself has the shaft (8) as supporting element, which is here lead through the supporting pillar (4), and to which the underarm supports (13), the chest support (16), the leg supports (11) and the seat support (18) are secured. The shaft (8) may be turned 180° by means of devices not shown. The desired height of the pillar (1) and the support beam (4) may be adjusted as set out under fig. 1. The device allows the patient to take the desired position on the operating table part (7) for docking as illustrated on fig.2. On fig. 4 the patient is seen from the rear in this position before the back and side supports are provided.

After the rear support (19) the back shield is placed on the patient, the person may be turned 180° about the shaft (8) to the position illustrated on fig. 5, after which the patient is intubated and anaesthetised.

On fig. 6 a conveyable variation of the turn-table device is illustrated. The support pillar (1) is ending in a substantially horizontal footplate (21) provided with wheels (22).
The operating table part (7) itself may preferably be detachably secured (docked) to the support (20) by means of securing bolts (22 and 24) as illustrated on fig. 7. The securing nut or wing screw or equivalent at the top of the bolt (23) (not illustrated) will lock the table (7) to the support (20). At the same time the turnability of the table part (7) in its main plane is achieved when this might be desirable about the bolt (23) when the bolt (24) is removed.

When the operating table device is not conveyable the vertical supporting device (1) may be partly located in a recess of a wall to save space the recess being of such dimensions and the location of the device (1) thus adapted that the horizontal supporting device (4) may be turned about the axes of the vertical device (1) towards or away from the wall depending on the operating table device being out of use or is to be used. This provides for possibility of space saving when needed.

In completely narcotized condition the patient is turned back into the position illustrated on fig. 4, the back support is removed and the operation can be performed. In contrast to the prior art the patient can by the present turntable device in alert condition place himself in position on the operating table part, and substantial movements of the patient when unconscious are avoided. Thus deleterious manipulations of an unconscious patient without muscular defence is abolished.

The design of the turnable operating table device depends among others on:

1. Whether the patient can be anaesthetized in the operating room or

2. in a separate anaesthesia room.

By alternative 1 the entire turn-table device may be constantly fixed stationed in the operating room (as illustrated on fig.1.).
The patient then enters from the rear side of the table which is tilted downwards (i.e. turned around the axes of the horizontal supporting device (4) enabling the patient concerned without difficulties to seat on the thus lowered seat (18). The operating table part can then be tilted to the position illustrated on fig. 2 with the patient in a knee-elbow-chest position with the feet on the knee supports (11), the chest on the chest support (16), the forehead on the head support (15), the underarms with the hands on the arm supports (13) locked to the operating table part (7) by means of the back shield (19) and side supports (17). The operating table part (7) with the patient strapped down is then turned about its horizontal axes 180° allowing the anaesthesist to fine-adjust the head of the patient for intubation (introduction of the tube into the trachea of the patient) and general anaesthesia. In deep narcotic condition the patient is turned back to the position for operation. The back shield (19) is removed, the side supports (17) may be left in position, and the operation can begin. When the operation is over, a bed is rolled up alongside the operating table and the patient is rolled sidewise over into the bed.

By alternative 2 either (a) the turn-table is embodied as one assembly being transportable with the patient docked to it to and from the anaesthesia room (as illustrated on fig. 6), or (b) the operating table part (7) itself may by a simple manipulation be detached from its rotation contact with the support (20) and thus also from the rest of the device standing in the anaesthesia room. Optionally the detachment may be performed by a coupling system which is indicated by K in fig. 3 by which a part of the horizontal support device (4) with the operating part device (7), support (20) and rotating device (6) may be detached.

In both cases the detached part, with the anaesthesied patient docked to it with his back up, is conveyed to the operating room and connected to the support (20) or corresponding interior
part of a horizontal support device (4) permanently positioned in the operating room.

It will be apparent to a man skilled in the art that several equivalents may be designed as variations of the devices described above. These are all to be considered as encompassed by the spirit of the present invention.

Further this turn-table device may be used for several other purposes than spinal surgery such as X-ray examinations and other diagnostic methods. It may then f.i. also be actual to secure the vertical extending device to the roof of the room instead of the floor or a mobile basis. The turntable is thus not to be considered restricted to surgical objects only, but also comprise other medical fields of use where benefits are achieved. The spirit of the invention is defined by the following claims.
New claims

1. Turnable operating table for spinal surgery in the knee-elbow position comprising the combination
   a) a vertical extending support device (1),
   b) a horizontal extending elongated device (4), of which at least one part being turnable about its horizontal extending axis in the longitudinal direction, which axis is running approximately perpendicular through a fixation to said abovementioned vertical support device (1), and is characterized by
   c) an operating table part (7) having fixation means (11, 12, 13, 14, 15, 16, 17, 18, 19) for a patient, which operating table part (7) is supported by the turnable horizontal extending elongated device (4) having fixation means (8) which makes the operating table part turnable at least 180° about an axis extending approximately in the horizontal plane through a patient from head to foot when this is secured to the operating table part, and which axis is perpendicular to the turn axis of the horizontal extending elongated support device (4).

2. Operating table of claim 1, characterized in that the vertical extending support device (1) is a pillar.

3. Operating table of claim 1 and 2, characterized in that the vertical extending support device (1) is fixed to a mobile basis.

4. Operating table of claim 1 - 3, characterized in that means are provided for rotating the elongated device (4) in connection with the vertical support device.
5. Operating table of claim 1 and 2, characterized in that the remote part of the elongated device (4) is turnable in a section (K).

6. Operating table of claim 1 - 4, characterized in that the vertical device (1) is raise- and lowerably connected to the support.

7. Operating table of claim 1 - 5, characterized in that the fixation means (8) of the operating table part (7) to the horizontal extending device (4) comprise a shaft extending approximately parallel or coinciding with the axis from head to foot of a patient secured thereon.

8. Operating table of claim 1 - 6, characterized in that the vertical extending support device (1) with its appending horizontal support device (4) and operation table part (7) by means of a docking system may be coupled and decoupled by a single manipulation.

9. Operating table of claim 1 - 7, characterized in that the operating table part (7) is turnable about the one fixation means (23).

10. Operating table of claim 1 - 8, characterized in that the fixation means (11,12, 13,14,15,16,17,18,19) comprise adjustable leg supports (11) having clamping means (12), adjustable underarm supports (13) having clamping means (14), a forehead support (15), a chest support (16), side supports (17), a seat support (18) and a back support (19).

11. Operating table of claim 1 - 10, characterized in that at least one part of the horizontal support device (4) is turnable 360° about its longitudinal axis.
AMENDED CLAIMS
[received by the International Bureau
on 24 April 1989 (24.04.89);
original claims 2 and 10 cancelled; remaining claims renumbered
as claims 2-9 wherein claims 4,6 and 8 are amended (2 pages)]

1. Turnable operating table for spinal surgery in the knee-
elbow position comprising the combination
   a) a vertical extending support device (1),
   b) a horizontal extending elongated device (4), of which
      at least one part being turnable about its horizontal
      extending axis in the longitudinal direction, which
      axis is running approximately perpendicular through
      a fixation to said abovementioned vertical support
      device (1), and is
      characterized by
   c) an operating table part (7) having fixation means
      (11,12,13,14,15,16,17,18,19) for a patient, which
      operating table part (7) is supported by the turnable
      horizontal extending elongated device (4) by a
      fixation which makes the operating table part (7)
      turnable at least 180° about an axis in the sagittal
      plane of the patient when the patient is secured in
      the knee-elbow position to the operating table part,
      and which axis is perpendicular to the turn axis of
      the horizontal extending elongated support device (4).

2. Operating table of claim 1,
   characterized in that the vertical extending
   support device (1) is fixed to a mobile basis.

3. Operating table of claim 1 and 2,
   characterized in that means are provided for
   rotating the elongated device (4) in connection with the
   vertical support device.

4. Operating table of claim 1,
   characterized in that the remote part of the
   elongated device (4) is turnable in a section (K), Fig. 3, 4
   and 5.
5. Operating table of claim 1-4, characterized in that the vertical device (1) is raise- and lowerably connected to the support.

6. Operating table of claim 1-5, characterized in that the fixation means (8) of the operating table part (7) to the horizontal extending device (4) comprises a shaft extending approximately parallel or coinciding with the sagittal axis of a patient secured thereon.

7. Operating table of claim 1-6, characterized in that the vertical extending support device (1) with its appending horizontal support device (4) and operation table part (7) by means of a docking system may be coupled and decoupled by a single manipulation.

8. Operating table of claim 1-7, characterized in that the operating table part (7) is turnable about the one fixation means (24).

9. Operating table of claim 1-8, characterized in that at least one part of the horizontal support device (4) is turnable 360° about its longitudinal axis.
## Classification of Subject Matter

According to International Patent Classification (IPC) or to both National Classification and IPC:

A 61 G 13/00

## Fields Searched

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SE, NO, DK, FI classes as above

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## Certification

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Date of Mailing of this International Search Report: 1989-02-27

International Searching Authority: Swedish Patent Office

Signature of Authorized Officer: Nils Andersson