Use of an Android application “clinometer” for measurement of head down tilt given during subarachnoid block

ABSTRACT

Context: Head down tilt is given to patients after sub arachnoid block for adjustment of height of block. However, the amount of tilt given is subjective and cannot be documented.

Aims: We used an android application named “clinometer” to measure exact degree of tilt given by anesthesiologists as their routine practice.

Settings and Design: This observational study, at a medical college hospital, was done in 130 patients given sub arachnoid block for lower abdominal surgeries.

Materials and Methods: We observed and documented vital data of patients and measured tilt given by application “clinometer.”

Results: We observed that the application was easy to use and measured tilt each time. The result obtained can be documented, digitally saved and transferred. In 130 patients studied, we observed incidence of degree of tilt as follows: 6-8° tilt in 38 patients (29.23%), 8-10 in 36 patients (27.69%), 10-12 in 30 patients (23.08%), 12-14 in 12 patients (9.23%) and 14-16° tilt in 14 patients (10.77%). Use of application was received with enthusiasm by practicing anesthesiologists. Various possible uses of this application are discussed.

Key words: Android application; clinometer; smartphone; subarachnoid block; tilt

Introduction

Sub arachnoid block is a common regional anesthesia technique performed for lower abdominal and lower limb surgeries. After the block is given, various factors decide the height of block like head down tilt given, baricity of local anesthetic agent used, speed of injection, barbotage with cerebrospinal fluid, etc. One of the factors, head down tilt plays an important role in the final height of the block. If no tilt is given, it may result in an inadequate low level. If excess tilt is given, it may result in block height of T2 or above, resulting in profound hypotension, nausea, vomiting and in some cases “total spinal.” Unfortunately, the majority of OT tables lack in the facility to measure tilt given. Anesthesiologists by their experiences develop a subjective assumption of a degree of tilt in a range which is safer for the patient but will have an adequate block. It works majority of times, but a significant number of patients still experience nausea and vomiting secondary to hypotension when more than needed tilt is given. Many other patients have...
inadequate levels resulting in distress to patient, surgeon and anesthesiologist, even necessitating conversion to general anesthesia. In this world of emphasis on patient safety during peri operative period, an important determinant factor like tilt cannot be left to subjective trial and error.

**Clinometer**

The new technology brings new horizons. Android operating system has become popular with new smart phones. They are the software platform for various applications. Applications in simple terms are task specific software programs designed as per a specific demand. Any desired function can have a dedicated application. Thus for every need an individual, focused, task specific application can be designed. It has now millions of such applications across a huge variety of categories as utility, games, entertainment, productivity, educational, etc. These applications utilize various components present in hardware of a gadget and achieve the target. Among the array of hardware, various sensors are present as accelerometer, gyro sensor, compass, proximity, humidity, barometer, temperature, etc. One of the application called as clinometer [Figure 1] designed by plaincode (app development + tech blog) (https://play.google.com/store/apps/details?id=com.plaincode.Clinometerandhl=en) utilizes the gyroscope sensor and determines the plane of gadget in vertical as well as horizontal directions. In simple terms it can measure the degree of inclination or tilt from a neutral position on a plane surface when used perpendicular to a surface and when kept in horizontal direction, it acts like spirit level to show whether the surface is flat. It can be downloaded free from play store available on android gadgets. By using this application, we can measure the exact degree of tilt given after sub arachnoid block, thus making tilt given objective and quantitatively documented.

**Materials and Methods**

After permission from Ethical Committee of Institute, this observational study was conducted on 130 patients receiving sub arachnoid block for lower abdominal surgeries operated on surgical patients. All the patients were evaluated in preanesthetic examination and all the patients found fit for regional anesthesia were included in the study. The vital characteristics as age, weight, height, sex, registration number, surgery to be performed were noted. Consent was obtained. Under all aseptic preparations, all patients received injection bupivacaine (0.5%) 4 ml with 26 G spinal needle in L3-L4 interspace. After attaining supine position, tilt was given by the anesthesiologist according to his/her usual practice. Final degree of tilt given was measured using clinometer application (app) by observer while keeping on table anesthesiologist blind. A screen shot was captured and a caption was added as register number [Figure 2]. Highest level of block was noted after 15 min. Successful completion of surgery with patient remaining comfortable was considered to be adequate level of block. Apprehensive patients were give injection midazolam 1 mg intravenous (IV). Nausea and vomiting, if occurred, was treated with injection ondansetron 2 ml IV. Hypotension more than 20% of preoperative level was treated with fluid challenge and injection mephenteramine in 3 mg IV doses. Any surgery converted to IV sedation and general anesthesia was excluded from the study. Besides the routine monitoring following additional parameters were observed, recorded and analyzed:

1. Degree of tilt given in patients.
2. Comfort regarding availability of smart phone.
3. Comfort regarding the use of the application.
4. Screenshot of tilt given to patients.
Results

A total of 130 patients were finally included in the study. Vital data observed of age between 20 and 50 years. Weight was between 40 and 60 kg. The height was between 5 and 5 feet 8 inches with all the observed data spread uniformly throughout the observed population. We observed incidence of degree of tilt in the patients as follows: 6-8° tilt in 38 patients (29.23%), 8-10 in 36 patients (27.69%), 10-12 in 30 patients (23.08%), 12-14 in 12 patients (9.23%) and 14-16° tilt in 14 patients (10.77%) [Figure 3].

Every time smartphone was available with the observer. The application opened up every time without fail. Observing the tilt given and noting down the degree or saving a screen shot for the record was also without any hassle every time.

Discussion

Anesthesiologists are alchemists of medicines, techniques, and gadgets. Being such a vital branch, emphasis on safety of the patient cannot be over emphasized. With time to time, various new technological breakthroughs have been introduced to safeguard patients well-being while providing sufficient operative playfield and time to surgeons. We have introduced a new method to measure tilt given during subarachnoid block, an android application called as clinometer.

Android smart phones and applications

Smart phones differ from mobile phones by being capable of multitasking. These smart phones running on various platforms as Android, iOS, Windows, have applications or apps, which are software programs dedicated to specific tasks. With this comes the whole spectrum of applications ranging as games, books, utility, office, travel, etc., the increasing efficiency of hardware with updated software at affordable prices has only added to their popularity and extensive use.

Clinometer

We used an android application named “clinometer” for an interesting task [Figure 1]. This application uses gyroscope sensor in smartphone and thus is able to measure any tilt given from a neutral position or level. It can also measure any change of angle in horizontal level, similar to spirit level as shown in screen shot [Figure 4]. We have measured tilt given by anesthesiologists after sub arachnoid block with hyperbaric bupivacaine to achieve an adequate level.

Advantages

First of all we were amazed by the simplicity of use as we have to just open the application and put it horizontal on to table, and we can see the exact tilt give in two point to decimal. With advancements and decreasing price of smart phones, the availability of a smart phone will never be an issue. Again we can capture screen shot for each and every patient and attach a caption regarding registration number, date, etc., and thus can have documented evidence for all. This tilt can be included in the anesthetic record and can be useful in medicolegal instances. The record being digital can be saved and can be transferred to other gadgets or a central server as an addition to Anesthesia Information Management System thus further increasing utility and scope of the information gathered for documentation and research. We can observe the routine practice of anesthesiologists and later share our results with them thus providing them with a chance to improve their practices.

In our study, we found out that approximately 80% of patients were given the tilt in the range of 6-12° as a part of practice thus showing that the anesthesiologists are on a cautious side when giving tilt without measurement. After the data were shared with them, they agreed unanimously that they will be more confident to give a greater tilt if they exactly know the degree of tilt. We can observe tilts with respect to patients body weight, height, sex, etc., and thus recommendations can be laid down for a range of degree of tilt that can be safely given. All anesthesiologists observed ranging from
PG students to senior professors were interested in the application and showed an inclination to use it. A separate slot in operation tables to keep an android gadget with clinometer will make it more user-friendly.

Again we may find various uses as to give and measure exact head up a position as required. This application may be useful to put patient to exact angles and tilt required when giving various nerve blocks for pain management, thus making the procedure more accurate and increasing chances of clinical success

Though this may be the 1st time that head down tilt is measured using an application, attempts to give measured tilt especially left lateral tilt following spinal anesthesia in lower segment caesarean section (LSCS) are reported.\textsuperscript{[2,3]} A study by Haleem et al.,\textsuperscript{[4]} compare the effects on intrauterine resuscitation by table tilt versus pelvic tilt position after spinal anesthesia for caesarian section. Though they did not mention in material and methods how they gave 15° lateral table tilt, our findings will help researchers and clinicians to carry out such maneuvers in tables not equipped with tilt measuring add-ons.

In a response to an article published in anesthesia, Ramamoorthy and Bailey, Letterkenny General Hospital, Letterkenny, Ireland\textsuperscript{[5]} have submitted their experience of using a similar application of apple iPhone “multimeasure” to measure left lateral tilt of 15° to be given to a patient undergoing LSCS under spinal anesthesia to prevent supine hypotension syndrome. They find the use of the application to be “easy and reliable way.”

Hence, we conclude that android application “clinometer” used for measuring head down tilt given after subarachnoid block works efficiently. It makes the procedure objective, easily documented, safe for patient and more efficient and stress-free for anesthesiologists.

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Conflict of interest
There are no conflicts of interest

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