

# The Hassiakos maneuver: how to test neuraxial anesthesia before Cesarean section

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**Background:** Neuraxial anesthesia has become the technique of choice for cesarean delivery, reducing the risks associated with general anesthesia. Intraoperative discomfort or pain is medical negligence; therefore proper assessment of neuraxial block is of utmost importance. In view of the variety of methods checking neuraxial blocks before cesarean section and lack of specific detail in the so far published literature, we first describe a specific testing maneuver which Professor of Obstetrics and Gynecology Dimitrios Hassiakos developed. **Methods:** This is a retrospective clinical study. All medical records of parturients who underwent elective cesarean section under neuraxial anesthesia between April 2015 and December 2020 with the same surgical team, were analyzed. **Results:** In all cases, the Hassiakos maneuver was performed prior to cesarean section. Absence of pain during the maneuver was necessary in order to start incision. No case of intra-operative pain was reported. **Discussion:** Several tests are available in order to check the level of neuraxial block for cesarean section. We first describe a simple and reliable testing method, based on deep pressure of the pyramidalis muscle.

## Keywords

Epidural; Neuraxial anesthesia; Pain; Cesarean section

## 1. Introduction

The vast majority of cesarean sections in our days are carried out under neuraxial anesthesia. General anesthesia is rarely administered [1]. Neuraxial anesthesia is safer and widely accepted [2]. There have been reported, however, cases of parturients, experiencing severe intra-operative discomfort or even pain during cesarean section under neuraxial anesthesia. Pre-operative level of blockade checking is crucial.

In a 2010 survey, the majority of anesthesiologists reported testing more than one modality when checking neuraxial block level [3]. Temperature testing with cold perception was reported as the most common procedure among anesthesiologists who wanted a sensory block to T<sub>4</sub> or higher. Of those who used fine touch, 99% aimed to a block to T<sub>6</sub> or higher. Analysis of textbooks and published literature reveals that the recommended upper level of block has risen with time, and that there is a trend towards using touch, rather than cold, as the ideal testing modality [4, 5]. It should

also be noted that motor testing is conclusive only for spinal anesthesia.

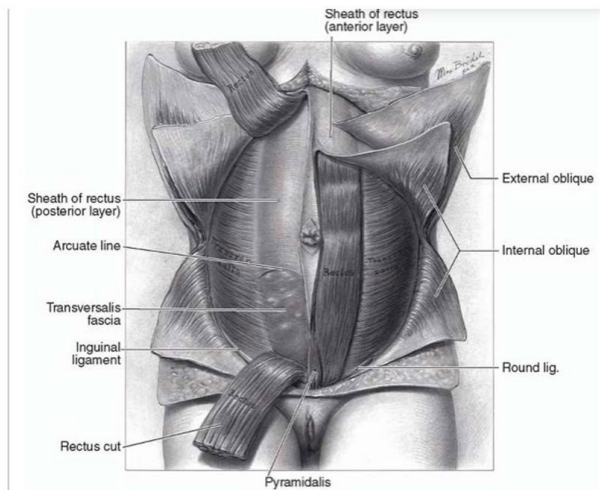
It is of great importance for Obstetric Anesthesiologists to accurately assess the level and density of neuraxial blockade prior incision. Patients experiencing pain during cesarean section under neuraxial anesthesia often accuse Anesthesiologists of negligence [6].

In this study, we first describe and analyze a maneuver that Professor of Obstetrics and Gynecology Dimitrios Hassiakos first performed, in order to double-check the level of anesthesia block prior to every cesarean section.

The Hassiakos maneuver is a simple test before cesarean section, based on deep pressure of the pyramidalis muscle. The pyramidalis muscle originates from the pubic symphysis and pubic crest (Fig. 1). The part of the muscle originating from the symphysis arises by ligamentous fibers, while the bony attachment arises by tendinous fibers. The muscle belly narrows down as it courses superiorly and inserts to the linea alba, halfway between the umbilicus and pubis. The pyramidalis muscle lies within the rectus sheath, a multilayered fascial compartment composed of the aponeuroses of the external abdominal oblique, internal abdominal oblique and transverses abdominis muscles. Within the sheath, the pyramidalis lies superficially to the inferior part of rectus abdominis muscle.

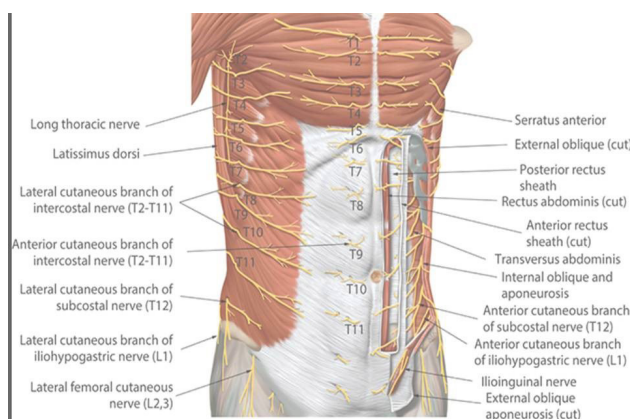
This is the exact point where Professor Hassiakos performed the maneuver. Applying deep pressure from the doctors' fingers to pyramidalis muscle, two centimetres above pubic symphysis, all reactions of parturient are examined. Only the sensation of pressure is acceptable. If the parturient complains of pain, then the surgical team must wait. The block is reassessed by the Anesthesiologist.

According to neuroanatomy, this maneuver tests a nerve larger than the rest of the area of Pfannenstiel incision: the subcostal nerve, known as the anterior division of the twelfth thoracic nerve. Subcostal nerve communicates with the iliohypogastric nerve and the ilioinguinal nerve of the lumbar plexus, and gives a branch to the pyramidalis muscle (Fig. 2). The anatomy of the subcostal nerve offers a potential explanation about the mechanism of the proposed maneuver. It



**Fig. 1. Transverse abdominal and rectoabdominal muscles.** From Te Linde's Operative Gynecology Tenth Edition J.A. Rock and H.W. Jones III Wolters Kluwer/Lippincott Williams & Wilkins.

seems that the maneuver assesses the blockade of the larger nerve of the surgical incision area: the subcostal nerve.



**Fig. 2. Innervation of the pyramidalis muscle from subcostal nerve (T12).** From: Karmakar MK, Soh E, Chee V, Sheah K. Atlas of Sonoanatomy for Regional Anesthesia and Pain Medicine. Mc Graw-Hill Education.

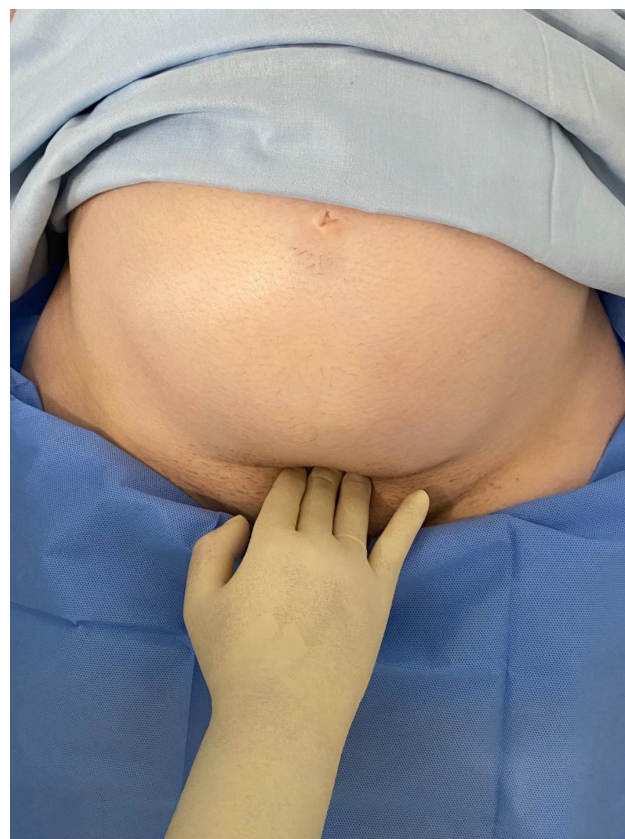
The aim of the present study was to identify the efficacy of the Hassiakos maneuver as a reliable for anesthesia level block checking, prior to cesarean section.

## 2. Materials and methods

This retrospective clinical study was performed at Leto Maternity Hospital (Athens, Greece) between April 2015 and December 2020. The study group consisted of parturients who underwent elective cesarean section performed by the same Obstetrician (C.G.) via Pfannenstiel incision, under combined spinal epidural anesthesia. Spinal anesthetic doses ranged from 1.6 to 2 mL of ropivacaine 0.75%. When missed dermatomes within the main area of block were noted, epidu-

ral administration of ropivacaine 0.75% occurred. Exclusion criteria were emergency cesarean section, cesarean section after trial of labour, cesarean section under general anesthesia, or classical cesarean section via vertical incision. All patients' records including medical history, surgical report, anesthesia diagram and perinatal care details were examined. Approval from Leto Maternity Hospital Ethics Committee was given (39/2021).

The Hassiakos maneuver is based on immediate deep pressure of the pyramidalis muscle for 2–4 seconds, using the three middle doctors' fingers of the right hand, two centimetres above pubic symphysis, with the parturient in a supine position (Fig. 3). The technique is applied after Foley catheter placement and just before skin prep, approximately 15 minutes after neuraxial anesthesia. Prior to the technique, usual testing methods of neuraxial blockade such as temperature examination via cold perception, pin prick or fine touch were performed.



**Fig. 3. Application of the Hassiakos maneuver.**

The same technique was used even in cases of obese parturients, or in cases of prematurity or multi-gestation pregnancy.

The purpose of the Hassiakos maneuver is to examine the intensity rather than the level of neuraxial blockade prior to caesarean section, in order to ensure a pain-free operation. The primary outcome of the study was to identify the

incidence of patients complaining of pain during caesarean section after negative maneuver testing. In all study group cases, the operation started only after negative Hassiakos maneuver; that means only if there was no pain reported during pyramidalis pressure. In cases of positive Hassiakos maneuver (pain during the maneuver), the Anesthesiologist reassessed and topped up the block accordingly.

### 3. Results

In total, 434 parturients underwent cesarean section by the same Obstetrician (C.G.), during the study period, at Leto Maternity Hospital. Elective cesarean section under combined spinal epidural anesthesia via Pfannenstiel incision, was performed in 322 cases, which consisted the study group.

In all cases, the Hassiakos maneuver was performed before cesarean section in order to test the level of neuraxial block. The surgery started only when there was no sign of parturient pain (negative test).

In all cases where usual testing revealed an inadequate block, the Hassiakos maneuver elicited painful response (positive test). In 24 cases (7.45%) painful reaction was noticed during maneuver at the same time that other testing methods such as temperature examination via cold perception, pin prick or fine touch failed to determine appropriate sensory loss. In all 24 cases, parturients were uncertain of pain sensation during pin-prick test and of cold perception or did not speak the same language with their doctor.

In the 24 parturients with missed dermatomes within the main area of the block, the Anesthesiologists topped up the block from the epidural catheter, in order to achieve a higher or more intense level of anesthesia. Cesarean section started only when there was no sign of pain during the Hassiakos maneuver (negative test). There was no case of intra-operative pain reported after a negative maneuver. No intraoperative opioids or propofol were administered. No inhaled nitrous oxide was used. Pain was alleviated only through epidural catheter top-ups. There was no need for conversion of neuraxial to general anesthesia in any of the study group parturients.

### 4. Discussion

The upper dermatomal level of blockade that should be achieved for neuraxial anesthesia during cesarean section is controversial and recommendations in textbooks as well as published studies vary: from T<sub>8</sub> to T<sub>4</sub> [7, 8]. By interrupting the transmission of painful stimuli and abolishing skeletal muscle tone, neuraxial blocks can provide excellent operating conditions. Sensory blockade interrupts both somatic and visceral painful stimuli, whereas motor blockade produces skeletal muscle relaxation. The effect of local anesthetics on nerve fibers varies according to the size of the nerve fiber, whether it is myelinated, and the concentration achieved as well as the duration of contact. Spinal nerve roots contain varying mixtures of these fiber types. Smaller and myelinated fibers are generally more easily blocked than larger ones. This

is potential explanation about the efficacy of our proposed maneuver as it examines the blockade of the larger nerve of the surgical incision area: the subcostal nerve.

This data, in combination with the fact that the concentration of local anesthetic decreases with increasing distance from the level of injection, explains the phenomenon of differential blockade. Differential blockade typically results in sympathetic blockade (assessed by temperature sensitivity) that may be two segments higher than the sensory block (pain, light touch), which in turn is usually two segments higher than the motor blockade.

Some textbooks do not suggest which sensory modality to apply in order to check their recommended level of blockade for cesarean section, while others suggest testing two modalities for a given level of block, e.g., temperature and pin prick [7, 9, 10].

In agreement with Russell's observational prospective study, our study shows that the subcostal nerve as well as visceral pain pathways, require a more dense block to obtund this pain than is represented by conventional testing (temperature, pin prick, light touch) [11].

The limitations of this study lay in its retrospective nature and in the fact that no pain scales were used. Additionally, this is a single-centre clinical study. Further evaluation of the maneuver is required in order to be firmly established and generally accepted.

In conclusion, we believe that deep pressure of the pyramidalis muscle, given the name 'the Hassiakos maneuver' in memoriam of our Professor Dimitrios Hassiakos, is simple and yields reliable results.

### Author contributions

AT wrote the manuscript and worked on the study concept, design, data collection and analysis. CG was the Obstetrician who carried out the obstetrical parameter of this study project and also participated at the writing of the paper, data collection and analysis. All authors read and approved the final manuscript.

### Ethics approval and consent to participate

All parturients gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of Leto Maternity Hospital (approval number: 39/2021).

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### Conflict of interest

The authors declare no conflict of interest.

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