Abstract. – Aim: To compare combined spinal-epidural anaesthesia (CSE) VS spinal anaesthesia (SA) in caesarean section (CS) performed by Stark method.

Material and Methods: 200 women were prospectively studied before undergoing to a Stark CS in two groups: 95 patients were assigned to a local anaesthesia by SA (first group) and 105 women to CSE anaesthesia (second group). After a pre-load of 500 ml of plasma expander in both groups, SA was performed at the L1-L2 interspace with an injection of 5 ml of levobupivacaine 0.15%, with a 5 mcg of Sufentanil. The CSE was performed by a spinal-epidural injection at the L1-L2 interspace, primarily by 4 ml of levobupivacaine 0.125% and 5 mcg of Sufentanil, then by 3-7 mL of xilocaine carbonate 0.5% plus 1 mcg/ml of Sufentanil. Successively a CS by Stark method was performed in both groups. The recorded anaesthesiologic side effects in two groups were: motor block, intraoperative discomfort, vomiting, bradycardia and hypotension. Statistical evaluation was by Z-Test referred to the comparison of 2 portions with great, independent samples.

Results: In the group with CSE anaesthesia, the prevalence of side effects was less than in the group treated with SA, where the prevalence of the motor block and intraoperative discomfort were greater and statistically significant (p<0.001); so as the vomiting and bradycardia were all in a major percentage in SA group, but only significant for hypotension (p<0.001).

Conclusions: These preliminary data show that the association between CS and CSE anaesthesia in elective CS by Stark method allow to have less intra and post-operative side effects; further studies need to provide specific details on the anaesthetic and surgical techniques, to tailor and optimize both in each patient to select for surgery.

Key Words: Obstetric anaesthesia, Caesarean section, Combined spinal-epidural anaesthesia, CSE, Spinal anaesthesia, Hypotension, Epidural anaesthesia, Obstetric surgery, Side effects.

Introduction

Cesarean section (CS) by Stark method (or Miskav Ladach method), the most utilized by obstetrics, grew out by an approach to opening the abdomen developed by Joel Cohen for abdominal hysterectomy in 1954.

Stark CS allows an improving of the postoperative performance, a reducing either short and long-term maternal morbidity or time need for the operation, a less touching of pelvic viscera, an avoiding abdominal retractors and a modest detaching of bladder.

The use of anaesthesia may be in general or in local practice, by epidural or in spinal technique, ever performed by a sensory block from T4 to S5.

The main problem of the spinal anaesthesia (SA) is the risk of the hypotension and of the local toxicity with an extensive sensory block, for the high dosage of drugs requested. The epidural anaesthesia (EA) may be inadequate in more than 25% of women because of difficulty in the blocking sacral roots, that results in visceral pain due to a bladder stimulation: epidural space has a median dorsal fold that leads to a compartmentalization of the epidural space.
A. Malvasi, A. Tinelli, M. Stark, G. Pontrelli, A. Brizzi, R.G. Wetzl, D. Benhamou

both University-affiliated Hospital in south east of Italy, in the period between January 2006 and May 2009.

The women had their CS in these two departments.

The anaesthesiologists share the choice of anaesthesia with gynaecologists and neonatologists, because these Institutions are a Baby Friendly Hospitals (a UNICEF/WHO initiative that promotes human breastfeeding), interested at reducing the impact of the anaesthesiologic and surgical techniques used on the babies.

Both CS as well as the antenatal and post surgical care were provided by the same core obstetrical teams in these institutions.

A total of 212 full term Caucasian parturients, scheduled for elective CS, were eligible and invited to participate in the study. However, only 200 gave their informed and written consent, approved by the institutional local Ethics Committees.

Women were consecutively allocated in two groups according to anaesthesiologic method to use: group I of 95 patients undergoing a SA and group II of 105 of the patients undergoing a sequential CSE anaesthesia.

The including criteria for this study were a scheduled elective CS to perform for breech and other malpresentations, post-term pregnancy in advanced maternal age and macrosomia.

The exclusion criteria included any additional previous abdominal general or gynaecological surgery and the following conditions and complications during the pregnancy: infections, anticoagulative therapy, pre-eclampsia, HELLP syndrome, ruptured membranes for more than 36 hours, placenta previa and other placental pathologies.

A standardized intra venous pre-load of 500 ml of a plasma expander was performed to all patients before anaesthesia and 5 mg intra venous ephedrine injection after anaesthesia performing.

A combination of both anaesthesiologic methods is the combined spinal-epidural anaesthesia (CSE) who involves a single intrathecal injection of a lipid-soluble opioid with an epidural infusion of a solution containing both a local anesthetic and a narcotic drug.

The CSE anaesthesia combines the predicted effects of SA, but with the flexibility of EA, with minimal demand for drugs when compared with the single anaesthesiologic spinal method. A minimally invasive and “analgogenic” (pain free) surgical technique of elective caesarean section (Stark technique) can reduce the local anaesthetics requirements (and thus the drug burden on the neonate) with low intraoperative maternal discomfort and side effects (low-dose regional anaesthesia). Moreover, with the highly lipophilic isobaric local anaesthetic actually used, the intraoperative discomfort and the motor blockage can be further reduced choosing a CSE approach instead of single-shot SA.

Basing on these hypotheses, in this preliminary perspective study, we have compared the CSE anaesthesia vs SA in women undergoing to Stark CS.

Materials and Methods

The study was performed in two Obstetric and Gynaecologic Departments: “Santa Maria” Hospital of Bari and “Vito Fazzi” Hospital of Lecce,
The utilized technique of CSE anaesthesia in the second group was the following: a Whitacre 25-gauge needle (Beckton Dickinson) was used to deliver 4 ml of LB 0.125%, then 5 mcg of sufentanil to the spinal space, and a Tuothy 18-g needle to deliver 3-7 mL of xilocaine carbonate 0.5% plus 1 mcg/ml of Sufentanil; the spinal injection was in according to the patient’s height and slowly, after a negative aspiration of cerebrospinal fluid (CSF), and it was followed by the insertion of an epidural 20-g catheter for postoperative analgesia.

After anaesthesia, all the women were in supine positioning, with a wedge under their right hip, considering the possible side effects: hypotension (a 20% fall in blood pressure below pre-anaesthesia levels or systolic pressure below 100 mmHg) immediately treated by 5 mg of ephedrine i.v., bradycardia (defined as an heart rate reduction below 60 bpm) treated by 5 mg of atropine i.v., vomiting (treated by 4 mg of ondansetron i.v.), motor block (assessed using the straight leg raise, 50 min after anaesthesia) and intraoperative discomfort (above all in the uterine exposing and reposion management).

The Stark method in CS was used in all the cases, with the classical Joel-Cohen laparotomy (JC-L), and the Munro-Kerr low uterine segment incision.

Briefly, the surgical steps of the standard Stark CS were: the incision by JC-L, so that the subcutaneous tissue is left undisturbed apart from the midline and the rectus sheath is separated along its fibres. Then, we separated the rectus muscles by pulling, opening the parietal peritoneum by stretching with index fingers and by anatomical forceps for grasping the visceral peritoneum around the vesicouterine peritoneal flap. We cut it by a scalpel and performed a small midline incision.

Using both the index fingers visceral peritoneum was stretched laterally in both directions for about 4 cm laterally and caudally for 3 cm down to detach it transversally by the uterine surface and the bladder flap pushed down by fingers or by using Doyen valves.

A small transversal incision (of about 2 cm), was performed at the superior part of the low uterine segment (LUS) and stretched it in a laterally in both directions, gently to avoid its lacerations and stopping before lateral uterine vessels.

No intra-abdominal sponges, towels or swabs were used to minimize future adhesion.

The fetus was delivered and the placenta was removed after it spontaneously delivered. The uterus was briefly exteriorized and the myometrium of LUS was sutured in single simple layer, by extra endometrial continuous absorbable stitches of Vicryl 0 by Ethicon USA (Polyglactin 910, violet color, 0.35 pH Eur – M0 – 4-36.4 mm – ½ C, round needle, 70 cm).

Then haemostasis was performed and the visceral peritoneum was not sutured using anatomic forceps. Finally, the abdominal wall was closed by suturing of fascia, without abdominal muscles suturing and the skin is closed with two or three mattress sutures and the space in between is exposed with non-traumatic forceps for 5 minutes.

The compared outcome parameters of both anaesthesiological methods were: motor block, discomfort, vomiting, bradycardia, hypotension and vomiting.

The post-operative discomfort was checked by VAS scale: 0 (no pain) – 10 (maximal referred pain). If VAS was more than 3, clinicians were authorized to treat pain always by FANS (or, sometimes, by fentanyl).

All the results were analyzed, using SAS software (version 8), considering as significant a P-value < 0.05 in Z-Test referred to the comparison of 2 portions with great, independent samples.

## Results

The characteristics of both groups, similar and homogeneous, were shown in Table I.

**Table I.** Base-line characteristics of the study participants. Data are means ± SD.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Group I 95 women in SA</th>
<th>Group II 105 women in CSE</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>31.6 ± 3.9</td>
<td>33.2 ± 2.5</td>
<td>&gt; 0.05</td>
</tr>
<tr>
<td>BMI</td>
<td>23.9 ± 1.9</td>
<td>24.1 ± 2.6</td>
<td>&gt; 0.05</td>
</tr>
<tr>
<td>Parity</td>
<td>1.1 ± 1.4</td>
<td>1.3 ± 1.1</td>
<td>&gt; 0.05</td>
</tr>
<tr>
<td>Gestation (weeks)</td>
<td>39.2 ± 1.1</td>
<td>38.6 ± 1.7</td>
<td>&gt; 0.05</td>
</tr>
</tbody>
</table>
In women of group II who received CSE anaesthesia, the prevalence of side effects was less than the first group of women in SA, excepting vomiting, bradycardia and hypotension, all present but not statistically significant (p>0.05).

In women of the group I, the side effect prevalence was: 38 women with motor block (40%), 31 patients with discomfort (32.6%), 12 with vomiting (12.6%), 24 with bradycardia (25.2%) and 35 women with hypotension (36.8%).

The women of CSE group, had this side effects prevalence: 15 patients with motor block (14.2%), 14 women with discomfort (13.3%), 11 with vomiting (10.4%), 22 with bradycardia (20.9%) and 19 women with hypotension (18%).

The statistical analysis of these results, with the 5% of type I error probability (p=0.05), shows that the relative prevalence of motor block and intraoperative discomfort were statistically different and greater in the first group than in the second group (p<0.001 for motor block and p<0.001 for discomfort).

No statistically significance on the resting side effects were in two groups: p=0.147 for vomiting, p=0.067 for bradycardia, but it is statistically significant for hypotension in the first group (p<0.001). All these dates are summarized in Table II.

Discussion

The results of this study must be to considered since the Stark technique is one of the most current utilized methods to perform a CS. The Stark CS is called “Fast CS” or short CS for the fast abdominal access, of 15-20 min of duration, with a brief exteriorization of the uterus only for 3 minutes.

It has numerous advantages: less traumatic for the mother, with quicker post-operative recovery, less febrile reactions and less need for antibiotics, with a shorter period before that the normal bowel function returns, with less peritoneal adhesions and with less scarring in the abdominal layers8,9.

Moreover, it reduces the abdominal wall bleeding and, for its simplicity, it has performed quickly, in planned or in emergency sections1,2.

In this study, we performed the classical Joel-Cohen laparotomy, with avoiding the Pfannenstiel incision. In the classic Pfannenstiel method, in fact, the surgeon enters his hands in the abdominal cavity and places sponges laterally. This is a strong peritoneal stimulus which requires that the cephalic spread of the spinal anaesthesia reaches T4. Therefore, is a need for a large dose of drug to obtain an intense and extended spread of anaesthesia. The Stark method avoids to enter in abdomen by a classical laparotomy, but minimally just by hands into the abdomen and eliminate to retractors or surgical sponges using.

The only manoeuvre that requires an higher level of anaesthesia is the exteriorization of the uterus, so, to reduce the possible discomfort and embolic risks for the patient. We try to limit this step to the minimum time necessary. Probably, this minimally invasive CS method reduces, overall, the need of anaesthesia.

Nevertheless, the Stark CS has been poorly studied in terms of pain and anaesthetic needs. Furthermore, discussing surgical experiences recorded in the scientific literature, the studies comparing the Stark method with the traditional low transverse CS were not often homogeneous, for the few reference about all the types of anaesthesia utilized.

Local anaesthesia by the CSE blockade has enjoyed increasing popularity in obstetric anaesthesia since many years: the usual procedure is to use a single space and a single needle for dural puncture, inserting a spinal needle through an epidural needle followed by insertion of a catheter10. A re-

Table II. Side effects showed in patients of the two compared groups of women underwent to CS.

<table>
<thead>
<tr>
<th></th>
<th>Group I 95 women in SA</th>
<th>Group II 105 women in CSE</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor block (N° of patient and percentage)</td>
<td>38 (40%)</td>
<td>15 (14.2%)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Discomfort (N° of patient and percentage)</td>
<td>31 (32.6%)</td>
<td>14 (13.3%)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Vomiting (N° of patient and percentage)</td>
<td>12 (12.6%)</td>
<td>11 (10.4%)</td>
<td>= 0.147</td>
</tr>
<tr>
<td>Bradycardia (N° of patient and percentage)</td>
<td>24 (25.2%)</td>
<td>22 (20.9%)</td>
<td>= 0.067</td>
</tr>
<tr>
<td>Hypotension (N° of patient and percentage)</td>
<td>33 (36.8%)</td>
<td>19 (32.3%)</td>
<td>&lt; 0.021</td>
</tr>
</tbody>
</table>
duced dose of one or of several drugs, usually lipophilic opioids and local anaesthetics, is primarily injected in the intrathecal space, to provide a rapid and effective analgesia with minimal muscle blockade.10

The epidural catheter is used if labour if the spinal block is insufficient or in case of CS, and it lasts longer than the spinal block.10

The CSE can achieve an optimal dissociation between sensory and motor block.

Analyzing techniques of anaesthesia, in CSE anaesthesia it is possible to optimize the combinations of local anaesthetic-opioid solutions by estimating the potency ratio of local anaesthetics, to provide the best effects with minimum untoward effects.12 It is a common scientific opinion that CSE blockade is a safe and valid alternative to conventional epidural analgesia and it has become the main technique for providing obstetric analgesia in many developed hospitals. The most widely-recognized advantage of this technique is the high maternal satisfaction with rapid and effective analgesia, to add to the preserving of the mobility of the lower extremities and to the more effective analgesia during CS.13

About the history of CSE anaesthesia, Brownridge used it in 1979 for the first time in obstetrics, during a CS, but in the last decade CSE has become popular especially in Anglo-Saxon countries, because it is connected to use of a very fine spinal needles and it has greatly reduced the post-dural injection headache (<1%) and in part improved knowledge of intrathecal opioid using, never proved before 1974.13

Currently, the intrathecal opioid using is largely diffused in anaesthesiology: scientists demonstrated that the morphine directly administration in the subarachnoid space depressed nociceptive impulse transmission, acting in the I, II and V Rexed’s laminae cells, in the dorsal horns. Opioids, in fact, act on specific receptors, at the spinal cord and trunk level, both responsible for the positive effects (analgesia) and negative effects (respiratory depression, vomiting and itching).13 At pre-synaptic C and A fibers level, the spinal action opioid mechanisms consist in the inhibition of P substance release, a mediator involved in medullar nociceptive impulse transmission. At post-synaptic level, on the other hand, the opioids seem to modify (in modulate and in-hibitive sense) the neural ionic currents (calcium and potassium channels), causing membrane hyperpolarization and potential rate and amplitude action reducing in the I, II and V Rexed’s laminae cells in the dorsal horns, with the consequent interruption of slowing of the nociceptive stimulus.13 The effect of intrathecal opioid administration depends on the affinity for the receptor and on the opioid’s capacity to reach it: conditioned by molecular weight, liposolubility degree and protein bindings.15 The ideal opioids in obstetric anaesthesia need to be liposolubes, as Sufentanil or Fentanyl, because of the following characteristics: easily enter in the spinal cord, a more rapid onset if compared to hydrosoluble opioids, a quick accumulation in the gelatinous substance of the posterior horn and a fast release from the spinal cord and accumulation in the plasma.

All these characteristics cause a brief stay of opioids in liquor, without depot effects or rostral spread, responsible of uncontrolled analgesia in time or side effects of long duration (as respiratory depression and alteration of consciousness). The administration of liposolubles opioids can modulate also the neuroaxial opioid effects.16

The epidural anaesthesia can have several problems. One is the crossing of the dura mater that activate the spinal action mechanism. Moreover the drugs also undergoes absorption by epidural adipose tissue, with a consequent vascular uptake; probably the ideal liposoluble opioid administration way is the spinal way, because effects and doses are more controllable.13 Another problem in epidural anaesthesia is the conditioning of the liposoluble opioid injection, basing on the entity of haematic flow, in the epidural plexus and in the epidural adipose tissue, all very changeable factors that influence the dural passage.1

In spinal anaesthesia, on the other side, the opioids come out quickly by the cerebro spinal fluid (CSF), where they rapidly arrive after producing their analgesic action, without accumulating inside and flowing in systemic circulation. This is possible since the opioids are not bounded to proteins in the CSF, without influence by pH or temperature variations.9

The action sites of local anaesthetics in subarachnoid spaces are either nervous roots or spinal cord, where blocking the sodium and potassium channels and inhibiting the generation and the propagation of the nociceptive stimulus. The local anaesthetics inhibit the P substance uptake, by a non-competitive way, binding to neuroaxial receptor and to inhibitory neurotransmitters, the GABA transmitters.13

Summarizing these data, in local anaesthesia seems certainly more useful to deliver opioids and local anaesthetics together in the subarach-
noid space, because the opioids seem either to facilitate the entry of the local anaesthetic to the neural cells, opening slowly the numerous sodium channels in C fibers and A fibers (TT resistant), or to hyperpolarize the cells, opening the potassium channels.

Associating local anaesthetics and opioids, it is possible to reduce the pharmacological doses and to obtain a better stabilization of analgesia with a side effects reduction.

Some hypotheses have been put forward to explain the subarachnoid block extension, possible with a sequential CSE anaesthesia after administration of local anaesthetic small doses, in the epidural space. All these hypotheses included: the existence of subclinical analgesia at a higher level, the leakage of epidural local anaesthetic through the dural mater in the subarachnoid space, the change in epidural pressure, the compression of theca by the epidurally injected volume of local anesthetic (or even saline) solution.

Anyway, a better intraoperative comfort by a right anaesthesiologic method yields more acceptable the CS to women and improves the working conditions of obstetrics. Another interesting aspect of CSE, is the minimal motor block that it produces, with a easy passing of the patients from operative bed to the stretcher at the end of CS, with a minimal nursing requirement.

Aya et al verified, in their study, the hypothesis of reduced stress and shorter duration with the CS by Stark method. At a low-dose anaesthetic level, if it can subdivide the anaesthetic dosage that anaesthesiologists will administer to the patient between two routes, respectively, the subarachnoid and the epidural one, they can obtain a better maternal and neonatal result.

The epidural dosage of local anaesthetics doesn’t reach the baby in the brief temporal lag between the induction of anaesthesia and the extraction of the fetus: the authors of this article believe this would be the case at least in the case of highly lipophilic isobaric local anaesthetic actually in use.

Leo et al performed a well-designed, meticulous study to ascertain the “optimal” local anaesthetic dose for CSE anaesthesia for elective CS. Their goal was adequate anaesthesia with the lowest incidence of hypotension. The results of this study, on the other side, cannot be adopted in all populations, institutions and countries, because there are other technical reasons that advice against the generalization of the optimal dose in each woman.

These factors are: genetic factors, opioid use, lumbar vertebral interspace, other technical aspects, such as the variability of the dose between the anaesthesiologic daily routine, the patient positioning and the different surgical technique.

Benhamou and Wong, in their editorial, affirmed that low dose CSE anaesthesia may not be the optimal technique for all patients and Institutions, so as the differences between the surgical technique (the laparotomical incision, the fundal pressure and the exteriorization of the uterus) are not linked to the patient’ discomfort, since they are fast and respect the anatomical landmarks.

The hypotensive effect caused by spinal/epidural anaesthesia with the subsequent blood pressure increase, could favour, during early puerperium, such bleeding complications, especially in patients with gestational hypertension.

**Conclusion**

The CS by Stark method is the result of developing physiological principles and causes less problems to the mother, but needs to be performed in the right anaesthesiologic method. In consequence of the evolution of surgical instruments and pharmacological knowledge, the CSE anaesthesia can be achieved as a safe technique to be preferred to spinal block, especially in the Stark CS, since it is a comfortable technique with less hypotensive effects.

The sequential CSE anaesthesia and the Stark CS, should be considered as important steps forward for a large part of women requesting an alternative choice to delivery, even if there are more type of CSs to adopt as per patients. Further studies need to provide specific details on the anaesthetic and surgical techniques, to tailor and optimize both in each patient to select for surgery.

**References**

Low-dose sequential combined spinal-epidural anaesthesia in elective Stark caesarean section


