

# Less is more—a minimal approach technique for Cesarean Section

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**Background:** The various techniques for performing a Cesarean Section (CS) have a long history. There are numerous surgical variations based on personal or local tradition, but these are not based on evidence and often have different outcomes on maternal and newborn health. Many modifications of the CS technique have been utilized in order to improve outcome with variable results both positive and negative. Several CS laparotomic methods have been developed but no consensus has been reached on the most optimal approach as related to safety and morbidity. **Methods:** The minimalistic approach of the Stark Cesarean Section (SCS) is compared to other methods through an evaluation of the studies published in the last 20 years comparing this technique with others, the systematic reviews and the personal experience of the authors. **Results and discussion:** The abdominal incision done at the Stark Cesarean Section differs from the Pfannenstiel incision by its location being above the arcuate line eliminating the need to separate the fascia from the recti muscles. The muscle separations being away from the pubic bone and the iliohypogastric and ilioinguinal nerves eliminates the risk of damage. This unique surgical approach is a logical, fast and simple one that eliminates unnecessary operative steps saving time and reducing complications. After fifteen years of experience and thousands of SCS performed at our departments, we may conclude that this method has several advantages over other surgical methods as related to short and long-term outcomes, including chronic/neuropathic pain and quality of life.

## Keywords

Misgav Ladach cesarean; Stark Cesarean Section (SCS); Techniques of Cesarean Section; Chronic pain

## 1. Introduction

While there are endoscopic solutions for most abdominal operations, Cesarean Section (CS) remains the most common indicated laparotomy. Cesarean Section is the most performed laparotomic operation in the world and therefore it

is important to utilize the most effective and safe method.

The CS procedure has a long history and there are many described variations due to personal or local traditions. These variations are often not based on scientific evidence and potentially can impact maternal and newborn's outcome as well as valuable healthcare resources [1].

Many modifications of the CS technique have been suggested with some surgical steps being shown to be minimally significant while others presenting major changes [2].

Different CS incisions have been utilized over the years with no consensus on the most optimal one as related to safety, post-operative pain and morbidity [3].

Nerves involvements following the CS seem to be the main reason for acute and chronic pain [4].

One of the most significant parameters for the quality of life (QoL) as related to acute or chronic pain after CS depends on the abdominal incision and its relation to the abdominal blood vessels and innervation. The post-surgical evaluation of wellbeing can subjectively and objectively be evaluated by pain scores obtained during early and long follow-up [5]. It is therefore important to define the optimal CS method and to employ its use in a universal manner.

The Stark Cesarean Section (SCS), also called the Misgav Ladach method, utilizes a modified Joel-Cohen abdominal incision as compared to the Pfannenstiel incision which is the most common abdominal incision currently used [6].

The Pfannenstiel incision was introduced at the end of the 19th century. The Stark Cesarean Section (SCS) was developed in Jerusalem by Michael Stark in the 90s and is now being used in many countries. The SCS utilized a modified abdominal incision method originally described for abdominal hysterectomy by Sidney Joel-Cohen, and includes numerous modifications [2, 7–9]. With the use of the Pfannenstiel incision, injuries to the lumbar plexus, to the ilioinguinal and ilio-

hypogastric nerves may occur resulting in prolonged numbness around the scar. Some women experience long-term radiating pain which may only be relieved surgically [5, 10].

The modified Joel-Cohen incision, as the one used in the SCS, is placed 3 centimeters below the line connecting both upper iliac spines and above the arcuate line where the fascia runs free over the muscles and away from the location of both the iliohypogastric and ilioinguinal nerves with resultant less risk of nerve-damage [6, 11]. As well as less risk of damage to the neurovascular structures [7, 12].

## 2. The Cesarean Section using the Pfannenstiel incision

The Pfannenstiel incision became popular among obstetricians for the following reasons: adequate pelvic exposure, reduced risk for post-operative herniation and satisfactory cosmetic result.

The skin incision is transverse in nature and approximately 3 cm above the symphysis with a length of 8 to 12 cm. The subcutaneous fat tissue is incised to the fascia and meticulous hemostasis is obtained. The abdominal recti muscles are separated from the fascia, including the linea alba and the pyramidalis and the separation is extended up to 6 cm cranially, often to the umbilicus. The muscles are then manually stretched laterally. The parietal peritoneum is opened transversely with a retractor being used to enable optimal exposure of the surgical site. The vesical plica is incised and pushed down with the uterine incision being performed transversely. After delivery, the uterine incision is usually closed in two layers. Also peritoneal layers are sutured in a continuous way (2–0 polyglactin suture) and the recti muscles are approximated (2–0 polyglactin suture). The fascia is sutured with a continuous locked suture (1–0 polyglactin suture) and the subcutaneous tissue is closed by interrupted stitches (2–0 polyglactin suture). Skin closure is done either intradermally (4–0 polydioxanone) or with interrupted skin sutures [13].

### 2.1 The Stark Cesarean Section (the Misgav Ladach method)—Less is more

The procedure is routinely performed under epidural or spinal anesthesia with the patient in Trendelenburg position with closed legs in order to avoid tension on the fascia while suturing.

The right-handed surgeon should stand on the right flank of the patient. The right hand is more sensitive and therefore an extension of the uterine opening beyond that necessary for delivering the fetus is prevented. Also, when suturing the uterus, the tip of the needle goes automatically away from the bladder decreasing the risk of lesioning the organ.

The abdominal incision is done with a modification of a method described by Sidney Joel Joel-Cohen for abdominal hysterectomy [14]. The incision is superficial cutting only through the cutis in a straight line about 3 cm below the line connecting both anterior superior iliac spines.

The deepening of the skin incision should be done only in

the midline, where no significant blood vessels are located, thus eliminating the need for hemostasis. When the fascia is reached, a transverse incision of 4–5 mm is performed. Then straight scissors with round tips are used, the tips opening for a maximum of 4 mm the fascia in order not to damage blood vessels. The scissors are then pushed to the left and subsequently to the right and fascia will be open as wide as needed. The opening of the fascia is done below the subcutaneous tissue and blood vessels.

The surgeon inserts two index fingers between the muscles and moves the fascia up and down. Then, aided by an assistant, the surgeon stretches the muscles with the index and middle fingers placed below the recti muscles pushing the fat tissue and the blood vessels laterally. The traction should be done slowly but firmly in order to enable the tissues to adjust to the stretching.

In order to prevent damage to any intra-abdominal structures, the peritoneum should be opened bluntly by repeated digital stretching above the bladder until a small hole is obtained [15]. Thereafter, stretching the hole up and down the peritoneum will be completely open transversally. Then a retractor maybe inserted.

Although uterus and cervix form a unique organ and develop together, their structure and function are completely different. The upper part of the uterus is characterized by a high percentage of muscle tissue [16]. It is obvious that we should try to open the uterus where there are as little muscle fibers as possible. Therefore, the plica and the bladder should be pushed gently down in order to expose the lower uterine segment. Then the plica is opened above the bladder and pushed down with the index finger of the right hand.

Thereafter the middle part of the lower segment of the uterus is incised transversely and superficially for about 4 cm with a lancet. It is important not to open with the lancet all the uterine wall in order to avoid injury to the presenting part. The uterus should instead be opened bluntly by the surgeon's fingers: the right index extends the opening of the uterus to the left while the left thumb finger extends the opening to the right side.

If the amniotic sac is still intact, it should be perforated either with a tip of the finger or the lancet. If the retractor was placed, it should be removed, then the surgeon inserts the right hand into the uterus encircling the presenting part and lifting it up, while the assistant exerts a downward pressure on the uterine fundus. After 40 to 60 seconds the umbilical cord is clamped and cut and the baby is given to the nurse.

Detachment of the placenta should occur spontaneously, but if this does not happen within the first 2–3 minutes, it should be removed manually, although this maneuver has been associated with a small increased bleeding [17]. After removal of the placenta, the uterus is exteriorized and at the same time compressed by two hands in order to reduce bleeding.

At this point the retractor should be in any case inserted and the central part of the lower margins of the open uterus

are grasped with a couple of forceps. The uterus is then sutured in only one layer with a big needle, preferably of 80 mm. This approach will leave less suture material to be reabsorbed [18]. A second layer has been demonstrated to add no value [19]. The sutures should be well locked to achieve immediate hemostasis. There is no risk for damage of the trapped tissues because the uterus starts involution immediately and therefore blood supply will not be restricted. If needed, individual single sutures can be utilized to secure further hemostasis.

The traditional use of abdominal towels should be avoided as they might cause adhesions [20]. After suturing the uterus, blood clots are removed from the pouch of Douglas and anteriorly, but liquid blood should not be preferably removed because it will be absorbed shortly from the intraperitoneal cavity and it does not increase risk of infection. The exteriorized uterus is placed then into the abdominal cavity.

The peritoneum should not be sutured, since a new tissue develops after a short time while a suture has the potential for increasing the risk of adhesions [21, 22]. The fascia and the skin are closed in the way that the surgeon prefers.

Pay only attention to the fact that, as the fascia should have been opened above the plica arcuate its two layers can be seen on the lateral sides. This should be included in the first and last knots in order to avoid herniation. The surgeon places two straight artery forceps on both ends of the incision, holding both layers together. Two additional vessel forceps are then placed on the upper and lower layers of the fascia at the third quarter of its length in the direction of the assistant. The two instruments should be held by the assistant close to each other in order to prevent tension on the sutures, but the closure should anyhow enable the surgeon to visualize the structures below. The surgeon continues suturing toward the assistant until the third quarter of the opening is reached. The assistant then removes the upper and lower forceps and lifts the lateral forceps.

The skin is closed with as less sutures as possible, usually by one midline Donati suture with a big needle including the subcutaneous tissue. This should be followed by two additional Donati stitches between the midline and the lateral end of the incision. Any open spaces between the sutures can be conjoined by Allis which should be left onsite for few minutes with more sutures being placed if adaptation is not optimal. Usually few hours after the operation, the abdominal bandage should be replaced.

Early hydration is recommended [23, 24] as well early ambulation in order to prevent thromboembolism.

Only ten instruments are needed for this procedure: scalpel, straight scissors with round tips, Doyen/Fritsch retractor uterine clamp, four straight clamps, surgical forceps, uterine forceps and needle holder. At times two or three Allis clamps may be used for closing the skin if necessary [25].

## *2.2 The influence of the operative techniques on short and long term outcome: fifteen-year experience at the Pula's General Hospital*

The introduction of the SCS technique at the Pula's Gynecology and Obstetrics Department dates fifteen years ago. During these years, two studies were performed in order to evaluate the short and long term outcome of this method compared to the traditional technique, when we were using the Pfannenstiel abdominal incision.

The aim of the first prospective study was to evaluate the short-term outcome of the SCS as compared to the traditional approach. The results demonstrated that SCS had significantly shorter operative time ( $P = 0.0009$ ) as compared to the traditional method and particularly the extraction of the fetus was much faster. The pain on the skin suture in the second postoperative day was significantly lower (0.021), mobilization resulted quicker ( $P = 0.013$ ) and there was significantly less need for pain killers after operation ( $P = 0.0009$ ). Bowel function restored sooner ( $P = 0.001$ ). The conclusion of the study was that SCS has clear advantages over the traditional approach. Moreover, no differences were shown when intraoperative bleeding, maternal morbidity, scar appearance, uterine involution or rate of febrile morbidity were considered [13].

The second study included patients with mean 5 years evaluated after the Cesarean Section performed either by the SCS or the traditional method. The age range of these women was 18 to 45 years. Women with postoperative complications, diabetes with neuropathy, spinal injuries or with any form of chronic pain or any other neurological condition including any co-morbid psychological disturbances such as anxiety were excluded.

The results of the LEEDS assessment of neuropathic pain showed that 16% of women from the traditional method group suffered from postoperative neuropathic pain, compared to 2% of women operated with the SCS. When we compared the evaluation of chronic pain persisting for over 2 months after operation, we observed it in 44% of patients operated with the traditional method compared to only 12% in the SCS group; moreover, the SCS group was reporting better VAS score results. The main location of the pain in both groups was referred inside and around the scar. The possible etiology of this pain was attributed to the iliohypogastric nerve lesions in both groups with only one patient having both the ilioinguinal and iliohypogastric nerves affected [4].

## **3. Discussion**

The minimalistic approach of the SCS method and understanding the abdominal anatomical area involved seems to be the reason why all the studies showed better short and long term results when the SCS method was used. This included postoperative recovery, maternal quality of life (QoL), and better results in post-surgical acute/chronic pain when compared to the traditional method using the Pfannenstiel incision.

The explanation may rely on the fact that the modified Joel-Cohen incision has a higher location above the arcuate line compared to the Pfannenstiel incision and therefore the muscle separations is enough away from the pubis as well from the anatomical location of the iliohypogastric and ilioinguinal nerves. The philosophy of this unique surgical approach was to transform a complicated operative technique into a logical, fast and simple one which has demonstrated to eliminate unnecessary operative steps, saving time and reducing the risks of complications.

The Pfannenstiel incision often involves the nerves of the plexus lumbalis resulting in a iatrogenic damage. We should consider that the ilioinguinal, iliohypogastric and genitofemoral nerves are running very close to the lateral edges of the Pfannenstiel incision. The accidental nerve damage might cause paraesthesia, dysaesthesia or local anesthesia. Moreover, in the traditional technique a sharp incision is used to access the abdominal layers (skin, subcutaneous, fascia, and peritoneum) while in the SCS, the sub-cutis and fascial incisions are approached only in the midline and then extended laterally by blunt finger dissection, perpendicular to the root of the nerves, therefore resulting in minimal or no nerve damage: in fact, the nerve elasticity allows moderate traction without anatomical damage. Knowledge of the nerve anatomy in the abdominal wall, as well as of the pathophysiology of chronic and neuropathic pain are fundamental for any gynecologist in order to understand where to better approach a laparotomy [11]. The SCS technique eliminates the need to separate the muscles from the fascia, and requires less force to separate the muscles: in this way there is a significant reduction of the risk of damaging blood vessels. Although chronic postpartum pain is associated mainly with neural damage, the increased rate of postoperative bleeding, the potential adhesions and fibrosis of the anterior abdominal wall more frequently associated with the Pfannenstiel abdominal incision may also contribute to the development of long term abdominal pain.

The modified Joel-Cohen abdominal incision may avoid the discomfort related to acute or chronic paresthesia/hypoesthesia which often impacts QoL after the caesarean section. Better results regarding the level of satisfaction with the appearance of the scar may be related to the reduced pain when the CS was performed with the SCS technique. It was shown that women who are pain-free are not too much interested about the scar's appearance and also respond more positively about their overall health.

The Persistent pelvic and/or abdominal pain after any laparotomy is a challenging problem. First, it does not imply a direct complication of the surgery. Any operation can cause trauma to any structure such as skin, subcutaneous tissue, fascia, muscle and peritoneum. This is already an explanation for chronic pain, which can have a major impact on physical, emotional, and cognitive function, as well as on social and professional life.

## 4. Conclusions

Most of the current abdominal operations have endoscopic alternatives while CS remains as the only one with an absolute indication for laparotomy.

After fifteen years of experience with over four thousand CS performed at the Pula's General Hospital, the SCS technique provides several advantages over other traditional CS operations relatively to the short and long term outcome, including chronic/neuropathic pain and quality of life.

Numerous studies compared early outcome of SCS compared to traditional CS. Without exception, all have demonstrated its advantages including the need for less post-operative analgesics.

## Author contributions

DB, MS, GCDR and DZ conceived and designed the study, analyzed the data and contribute to wrote the paper, AT and AM contribute to write the paper and to enterpretate the data. All authors read and approved the final manuscript.

## Ethics approval and consent to participate

Not applicable.

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## Conflict of interest

The authors declare no conflict of interest.

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