

Review of Advantages of Joel-Cohen Surgical Abdominal Incision in Caesarean Section: A Basic Science Perspective

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SUMMARY

Caesarean section is a common operation and the best postoperative outcomes are desired. Surgical techniques have been devised or modified to reduce operative and post operative discomfort. Many studies have evaluated or compared the Joel-Cohen abdominal incision with Pfannenstiel incision and found the former to be superior for various reasons such as less postoperative febrile morbidity, less analgesia requirements, shorter operating time, less intra operative blood loss and adhesion formation, reduction in hospital stay and wound infection in the group undergoing Caesarean section by this technique. This study is to find whether better postoperative outcomes of the Joel-Cohen incision group can be justified by the explanations of fundamentals of the basic sciences. Literature was reviewed for randomized clinical trials and review articles comparing the different kinds of abdominal incisions for Caesarean section. The study revealed that the Joel-Cohen method was beneficial. The fundamentals of basic sciences were studied to try to find an explanation to the enumerated advantages of the Joel-Cohen procedure; attributing to the differences in the techniques used.

KEY WORDS:

Caesarean section, Joel-Cohen abdominal incision, Pfannenstiel incision, Postoperative febrile morbidity, Postoperative analgesia, Postoperative adhesions

INTRODUCTION

The most common major abdominal operation done on women is Caesarean section. Over the past century delivery by Caesarean section has been increased in both developed and developing countries^{1,2}. Women today are four times more likely to undergo Caesarean section than thirty years ago. In many developed countries Caesarean section rate is 20-25%, but it varies from 3.5% in Africa to 29.2% in Latin America³. As with other surgical procedures, there is no one standard surgical technique for Cesarean delivery. The wide variation in surgical techniques in practice depends on many factors including the clinical situation and the preference of the operator. Various abdominal incisions have been used for Cesarean delivery. They include vertical incision (midline and para median) and transverse incision (Pfannenstiel, Maylard, Cherney and Joel-Cohen)⁴. In general, the transverse incision is associated with less postoperative pain, greater wound strength and better cosmetic results than the vertical midline incision. However, the vertical incisions

generally allow faster abdominal entry, cause less bleeding and nerve injury. It can be easily extended cephalad if more space is required for access⁵.

The transverse suprapubic skin incision is the most common technique used for Caesarean delivery in the developed world as well as majority of developing countries. The Pfannenstiel incision and Joel-Cohen abdominal incision are the commonly followed lower abdominal incisions in Caesarean section.

Pfannenstiel introduced the Pfannenstiel incision in 1900⁶. It is a horizontal incision about 2cm above pubic symphysis that curves gently upward, placed in a natural fold of skin. The subcutaneous tissue is incised sharply with a scalpel. Fascia on exposure is incised transversely and separated from the underlying muscles by blunt and sharp dissection. Once the fascia is dissected, rectus muscles are separated with finger dissection. The peritoneum is opened by sharp dissection in midline. The initial entry is then widened with fine scissors exposing intraperitoneal contents.

Professor Joel-Cohen (Figure 1) introduced an incision for abdominal hysterectomy in 1954, and obstetricians have since used this widely to perform Caesarean section⁷. The incision is a straight horizontal incision, being positioned slightly higher than the Pfannenstiel, about 3cm below the line joining the anterior superior iliac spines. The skin is cut; the subcutaneous tissue and the anterior rectus sheath are opened a few centimetres only in the midline. Both the fascia and subcutaneous tissue are rapidly divided by blunt finger dissection. The rectus muscles are separated by finger traction. The peritoneum is opened by blunt dissection in a transverse direction and the opening is widened by traction in a transverse direction.

In Maylard modification, the rectus muscle is divided either by sharp dissection or by electrocautery whereas rectus muscle is severed as low as possible from its lower incision in Cherney modification for better exposure of abdomen⁸.

The objective of the study is to analyse the comparative studies in literature of the commonly done abdominal surgical transverse incisions, discuss the advantages, search for other operations using the same techniques, discuss the outcomes, whether similar or not and apply the principles in basic science to explain the benefits of Joel-Cohen incision.

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MATERIALS AND METHODS

Electronic search was conducted using the key words such as caesarean section, incisions, post operative complications, Joel-Cohen, Pfannenstiel. A further search was carried out on all the advantages listed in the studies while comparing the various incisions. The effect of blunt and sharp dissection on operating time, pain severity, duration of post operative pain, post operative complication such as fever, infection were studied for operations on other regions since studies in this aspect pertaining to Caesarean section were limited. An electronic search was conducted to find the underlying basic science explanations for the findings observed in the studies such as the anatomy of the anterior abdominal wall and positions of the cutaneous nerves, effect blunt and sharp dissection on extent of tissue injury, nerve damage and regeneration, post operative adhesion formation etc.

Cochrane systematic review and randomised control trials are available for the techniques of Caesarean section⁹. The Cochrane review considers two random controlled trials involving 411 patients. The main outcome measurements were postoperative morbidity, need for analgesia within four hours after surgery, total dose of analgesics in first 24-hour, blood loss and blood transfusion, extraction time, total operative time, time between surgery and intake of oral fluids, pre, postoperative haematocrit, time from surgery to start of breastfeeding, length of stay, duration of stay in special nursery, and neurodevelopmental assessment of infant six

months of age. Febrile morbidity was defined as temperature elevation to 38°C on two occasions four hours apart, excluding the first 24 hour and in the absence of known operative or non-operative site infection.

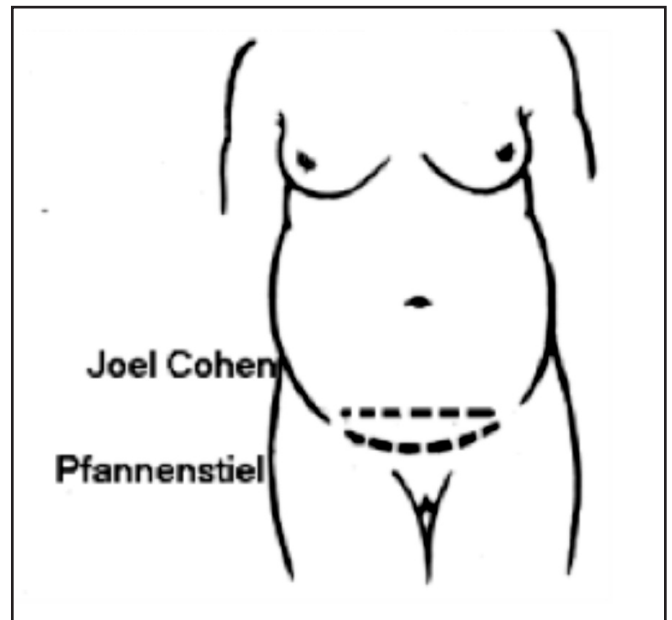


Fig. 1: Joel-Cohenincision and Pfannenstiel incision

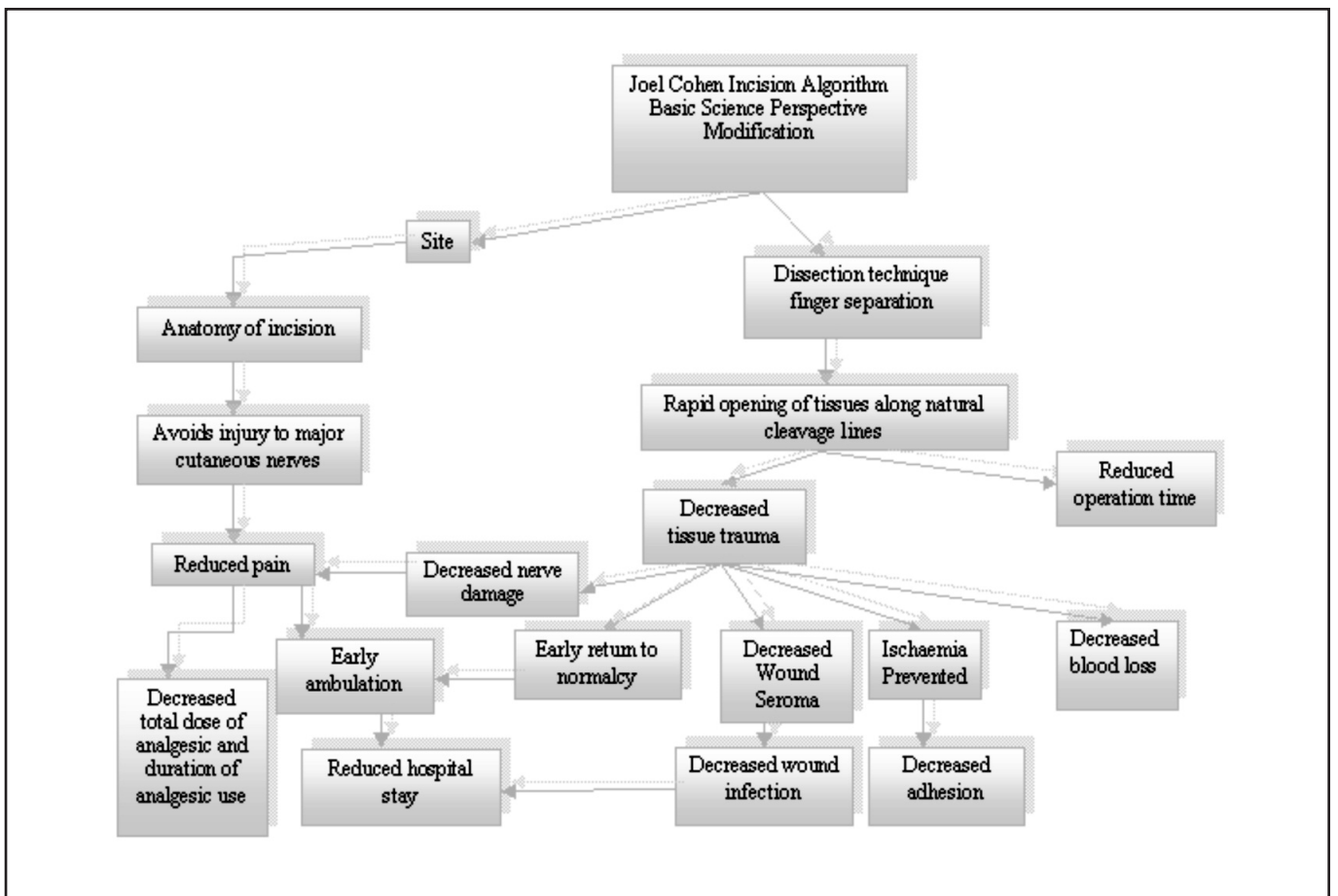


Fig. 2: Joel Cohen Incision Algorithm Basic Science Perspective

In the review on 411 women, there was a 65% reduction in reported postoperative morbidity overall (RR 0.35, 95% CI 0.14 to 0.87) in the Joel-Cohen group. Other outcomes were reported in another study¹⁰ (101 women). (i) Postoperative analgesic requirements were less in the Joel-Cohen group (RR 0.55, 95% CI 0.40 to 0.76); (ii) operating time was reduced (weighted mean difference (WMD) -11.40, 95%CI -16.55 to -6.25 minutes); (iii) delivery time was reduced (WMD -1.90, 95% CI -2.53 to -1.27); (iv) the time to the first dose of analgesia was increased (WMD 0.80, 95% CI 0.12 to 1.48); (v) the total dose of analgesia in the first 24 hours was reduced (WMD -0.89, 95% CI -1.19 to -0.59); (vi) estimated blood loss was reduced (WMD -58.00, 95% CI -108.51 to -7.49 ml); and (vii) postoperative hospital stay for the mother was reduced (WMD -1.50; 95% CI -2.16 to -0.84), compared to the Pfannenstiel group. All women in this study had surgery under spinal analgesia. No other significant differences were found in either trial. Women having Joel-Cohen incisions initiated breastfeeding earlier than those having Pfannenstiel incisions but this difference was not statistically significant (WMD -5.50, 95% CI -13.62 to 2.62 hours). None of the studies reported on postoperative voiding difficulties. There was no difference in the duration of infant's stay in special care baby unit in this study (WMD -0.46; 95% CI -0.95 to 0.03)¹⁰.

On analysing the individual randomised control study there were no differences in total operative time (32 vs 33 minutes), intra and postoperative complications and neonatal outcomes¹¹. The extraction time was 50 seconds shorter for the Joel-Cohen group (median, 240 seconds vs 190 seconds) implying minimal clinical benefits to mother and the fetus. The authors concluded that there are no clear indications for the performance of a Joel-Cohen incision. The third randomised control study is available in abstract form with fewer details of the methodology and included 268 women¹². The outcomes reported suggested a reduction in operating time (35 vs 26 minutes) and maternal composite morbidity (16.3% vs 7% $p < 0.05$, RR 0.51, CI 0.24, 1.05). The composite morbidity was unspecified in this study.

DISCUSSION

Both Joel-Cohen and Pfannenstiel are horizontal incisions. There is however a difference in the site of incision and technique used. The basic difference is that Joel-Cohen incision is at a slightly higher level and the dissection of tissues is by finger separation.

An electronic search for studies revolving round this surgical technique difference in other operations also revealed outcomes similar to this; i.e finger separation of tissues improves various outcome parameters.

Finger port is used to carry out finger dissection in difficult laparoscopic cholecystectomy in acute cholecystitis to improve effectivity¹³. In a prospective randomised, single blind, controlled clinical trial to determine the effect of the method of tonsillectomy on postoperative pain in paediatric patients, it was concluded that hot dissection tonsillectomy increases morbidity in paediatric patients in the recovery period compared to non-electric dissection tonsillectomy.

The return to normal diet was delayed, pain, analgesic requirement, pyrexia and bleeding was significantly more in the hot dissection group¹⁴.

No variation was seen in postoperative infection rates in the Joel-Cohen and Pfannenstiel incision groups. Literature review has very few studies determining the effect of blunt and sharp dissection on infection rates. A study showed that post operative bacteraemia in tonsillectomy cases were reduced in patients in whom bipolar cautery was used as compared to dissection¹⁵. However, the study was not randomised. Overt clinical infection rates have not been discussed. Postoperative antibiotic protocols variation for different surgeries may affect outcomes. Bacteraemia is not expected in Caesarean sections and postoperative seroma formation has been lower in the Joel-Cohen group which may reduce infection rates.

Basic science concepts regarding anatomy, tissue dissection, injury to vessels and nerves, tissue healing, systemic response to tissue injury, immune response were studied since these concepts would hold well for operations in different areas and conditions thus revealing similar postoperative outcomes.

The anatomy of the cutaneous innervations of anterior abdominal wall showed that the cutaneous branches of the subcostal and iliohypogastric were at a higher and lower level in the midline respectively. Complete severance of peripheral afferent sensory fibres results in hyperexcitability of damaged nerves. This causes stimulation of higher centres to perceive pain, and increases transmission of action potentials along adjacent undamaged unstimulated sensory fibres¹⁶. This explained the better outcome of pain relief, total dose and duration of analgesic requirements in Joel-Cohen incision group, where the incision was slightly higher compared to Pfannenstiel group. The musculocutaneous nerves of the anterior abdominal wall lie in a deep plane between the internal and transverse abdominus muscle. They pierce the rectus muscle and the anterior rectus fascia to become cutaneous¹⁷.

By definition, blunt dissection is a dissection performed by separating tissues along natural lines of cleavage without cutting¹⁸. The tissue splits entirely along the cleavage line and continuous dissection of tissue throughout its length is avoided. Tissues separate quickly along natural planes while performing finger dissection and hence reducing operating time and delivery time. There is no damage to nerve endings and blood vessels. Pain is not initiated as nerves are intact and hemostasis is achieved immediately thus reducing the time for wound repair. In the operative techniques which use sharp dissection or electrocautery, these nerves are liable to damage and therefore cause pain requiring early and more doses of analgesia.

Wound healing rate is increased when hematoma and tissue destruction is less¹⁹. Response to tissue injury is not severe hence there is a low febrile reaction. Reduced pain helps faster ambulation of patients. Shorter operating time assists earlier return of peristalsis due to minimal tissue handling and thus the time interval between operation and first feed is reduced. This results in shorter hospital stay.

The trauma of surgery and infection are two common causes of postoperative fever, surgical trauma being the major reason. The trauma elicits the production of host endogenous pyrogenic cytokines. The pyrogenic or proinflammatory cytokines like interleukin 1 (IL-1), is a primary activator of the febrile response to tissue injury and the local inflammatory response to infection²⁰. The greater the trauma it is more likely to activate the cytokine response with subsequent fever as observed in Pfannenstiel incision. Blunt dissection causes less tissue trauma in Joel-Cohen incision which explains the reduction in post operative febrile morbidity.

An analysis of 866 women with a Pfannenstiel incision for Caesarean delivery or abdominal hysterectomy, following follow up to two years showed that 32% experienced chronic pain at the incision site. Moderate and severe pain, which impairs daily activity, was reported in 7% and 8.9% of women and 53% of this group had nerve entrapment²¹.

The study (97 women) comparing the Maylard muscle-cutting incision with the Pfannenstiel incision reported no difference in febrile morbidity (RR 1.26, 95% CI 0.08 to 19.50); need for blood transfusion (RR 0.42, 95% CI 0.02 to 9.98); wound infection (RR 1.26, 95% CI 0.27 to 5.91); physical tests on muscle strength at three months postoperative and postoperative hospital stay (WMD 0.40 days, 95% CI -0.34 to 1.14)²². This is because, though the muscles are not cut in the Pfannenstiel incision, the nerves are damaged during sharp dissection of the sheaths while they traverse from a plane deep to superficial rectus sheath and hence the outcomes of both techniques are similar. The Joel-Cohen incision only separates tissue planes by blunt finger dissection and prevents damage to the nerve fibres. The finger dissection cleaves tissue in line of least resistance and the nerves and blood vessels are spared from damage. So there is less and delayed requirement of analgesics leading to shorter post operative discomfort and early breast-feeding.

Ischaemia causes delayed healing of peritoneum and more adhesions²³. The finger separation of tissues in the Joel-Cohen incision ensures that the blood vessels remain intact thus expediting recovery by the formation of fewer adhesions due to good oxygenation and absence of collection in between tissue planes²⁴.

All the benefits of the Joel-Cohen incision can be explained on the basis of basic science knowledge which has been summarised in the algorithm (Figure 2).

The length of the abdominal incision was a critical factor in the degree of difficulty in delivery. No randomized-controlled trial is available of skin incision length to ensure optimal outcome of both mother and fetus. However, two non-randomised studies^{25,26} suggest that abdominal incision size should provide at least 15 cm of exposure to assure optimal outcome of both mother and fetus.

Considering the massive number of Caesarean sections being performed world over, the number of cases studied is very minimal. Larger case control studies on the differences between Joel-Cohen and Pfannenstiel are needed to prove the

efficiency. For Joel-Cohen incision, based on the strong foundation of basic science principles it may be prophesied that, larger case control studies will still conclude the supremacy of Joel-Cohen incision.

CONCLUSION

In this study, a literature search has been done which showed that the Joel-Cohen incision was superior to other abdominal incisions for Caesarean section. The benefits listed by the use of this incision have been shown to have a justification by a literature search for similar outcomes in other operations. An attempt has been made to study the principles involved in the operative steps used in Joel-Cohen incision from the basic science perspective. A satisfactory explanation has been sought for most of the benefits achieved by the Joel Cohen incision. Randomised trials, with large number of cases have yet to be done. Based on the basic science review, the superiority of Joel-Cohen incision for better postoperative outcomes can be expected.

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