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Review Article

Drying the biggest channel for unnecessary minimally invasive surgery through MAGIC versus TRAGIC caesarean section

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Abstract

Keyword:
caesarean section, pelvic adhesions, iatrogenic secondary infertility, ectopic pregnancy, uterine niche, niche related, prevention, ectopic pregnancy and placenta accrete spectrum.

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The national and international rates of caesarean section (CS) are tremendously increased and the reasons behind this annoying increase in the CS rates are multifactorial. Unfortunately, and there no instant recovery plans or hopes for bring to an end this frustrating problem. Unacceptably, most of the unsoundly indicated CSs are not done in professional manner therefore an epidemic of frustrating complications are encountered in the daily practices. Namely, pelvic adhesions, iatrogenic secondary infertility, ectopic pregnancy, uterine niche, niche related pregnancy and placenta accrete spectrum are examples of the complications of unprofessionally performed CS. Most of those unwelcomed complication will require a form or another of minimally invasive surgeries (MIS) with its anticipated, costs, patient's inconveniences, complications as well as adverse outcomes specially in severer forms of CS complications. This article highlights how to avoid or minimize the occurrence of CS complications and consequently eliminating the needs for subsequent unnecessary MIS.

Summary & condensation page:
Précis: Unprofessionally performed CSs (UPCSs) represent a major channel for subsequent needs for minimally invasive surgeries (MIS). We present special advices and technical tricks for prevention of CS complications and drying this major channel aiming at minimizing the needs for unnecessary MIS

Introduction

The practice of CS is progressively increasing globally and will remain increasing over the present time where both unmet needs and overdoing are anticipated to coexist. Unfortunately, there is absence of globally effective measures to revert the trend and the unsafe providing of CS and with the accompanying overuse of the surgical procedure which drains resources and adds unnecessary morbidity and mortality. Measures addressing the CS rates, indications, safety and technical refinements is a global priority.[1]

Normal vaginal birth is a physiological and natural process. However, in certain conditions, a caesarean section may be essential for protection of the woman`s and the baby's well-being. In those environments, underuse of CS contributes to amplified maternal and perinatal mortality and morbidity. Equally, overuse of CS with no medical indication has not shown additional advantages to vaginal birth and may generate needless complications and waste the human and financial resources.[1–3] Consequently, optimising the use of CS is of global concern and a challenge in public health.[4, 5]

In this article the authors a group of issues related to CS and its preventable complications that requires subsequent MIS for correction. Those issues include; the external pop out (EPO) modification foetal head extraction as a minimally invasive technique for foetal head extraction,[6] the common preventable complications of CS, special advices and technical tricks for prevention of such complication, treatment of existing post CS adhesions, and summarizing acronym of MAGIC and TRAGIC CS. Our goal is present a practical plan and a map road for drying the channels and minimizing the needs for unnecessary subsequent MIS for correction of the resultant complications of unprofessionally performed CSs.

The external pop out (EPO) modification of the current practice of foetal head extraction:

Classic head extraction during CS entails the introduction of the surgeons` hands or fingers into the incision of the lower uterine segment LUS). This action is in contrast to what obstetricians do in normal vaginal delivery (NVD). In another word in NVD obstetricians never introduce their hands or fingers into the birth canal of the parturient women. Instead, obstetricians used to do perineal support aiming at perineal protection against tears and incisional extensions. The LUS during CS is

not offered such protection while it`s much more vulnerable to incisional extensions than the stronger perineum is during NVD. The EPO technical modification as a novel way for LUS support during CS was first published in the year 2017 and came the conclusion that, EPO technique is feasible with small rates of LUS extensions. The procedure seemed to be safe with lower rate of intraoperative and post operative complications. It carries the advantage of being simple, easy, with a short learning curve. The EPO technical modification gives the advantage of LUS support during fetal head extraction thus offers a protection to the LUS mimic to that protection offered to perineum during NVD.[6]

Common preventable complications of CS:

A- Pelvic adhesions:

In our routine daily practices post CS pelvic adhesions represented the commonest cause of secondary infertility. In a cross-sectional study conducted at the Tanta University Hospitals pelvic adhesions were found in (73.13%). Adhesions were tubal in 55.10%, ovarian in 20.40%, combined tubo-ovarian and omental adhesions in 11.22%, uterine adhesions in 6.12% and a frozen pelvis was found in 7.14%. [7]

There was no correlation between the severity of the adhesions and the number of previous caesarean sections (CS). A fact that points to the probability of adhesiogenic faults in CS technique.

The data of the Egyptian study concluded that pelvic adhesions are common in patients with secondary infertility following CS and different degrees of adnexal adhesions to the lateral pelvic wall characterize a pathognomonic feature in post-CS infertility.[8]

B- Uterine scar niche:

Uterine niche is a discontinuation of the myometrium and endometrium after CS. Niche development subsequent to a CS is a common problem. Ultrasonographic studies indicated a frequency of niche between 56% and 84% after CS. [9]

Uterine niche development was suggested to occur with low incisions at cervical tissue, adhesion formation, poor approximation, advanced cervical dilatation, low uterine incisions, low head station, non-closure of the peritoneum, and creation of a bladder flap. If prevention or minimization of uterine niche is desired, the optimal C-section protocol should avoid low uterine incisions,

choose uterine closure technique based on the surgeon's proficiency (double-layered non-locking is reliable), and close the peritoneum, and myometrial injection of PRP/MSC may be a useful adjunct intervention pending further clinical evidence.[10]

However, from the authors point of view, uterine niche is almost totally preventable iatrogenic complication of CS. The most important factor in niche development is the professional failures to obtain a niche non-generating technique. With special attention related to CS technique, a bundle of practical tricks explained later in the MAGIC CS acronym, both niches and adhesions can be eliminated form practice or fallen to a minimum.

C- Ectopic pregnancy:

One of the important causes of ectopic pregnancy (EP) is the post CS adhesions. The pathophysiology of EP that follows a CS is strongly related to peritubal adhesions that interfere with normal motility of the Fallopian tubes or resulting in non-obstructive tubal kinks. The most common causes of peritubal and tubo-ovarian adhesions are infections, the use of dry towels with serosa damage and other adhesiogenic attitudes.[11]

The surgical management of EP is best to be carried out by a MIS through laparoscopy.[12] However, in the presence of adhesions, laparoscopic management of EP become problematic and requires well trained laparoscopic surgeon. In addition, post CS ectopic can be avoided or its occurrence rate can be minimized by adherence to the steps of MAGIC CS specially the use of irrigation and suction as an alternative to using dry towel toilets.

D- Uterine scar ectopic or niche related pregnancy:

The frequency of diagnosing uterine scar ectopic (USE) or niche related pregnancy (NRP) is increasing primarily due increased rates of CS in general and particularly unprofessionally performed CS. In addition, the professional use of early US scanning is in part responsible for increased early diagnosis. In most instances, both USE and NRP could be the same and both has the same management lines on either the preventive or therapeutic levels. Secure, edge to edge, raw surface to raw surface, equal bite to equal bite and tension free suturing during closing the LUS incision is the key for prevention of uterine niche and subsequent NRP. The expectant management after professional US evaluation of USE and NRP seems to be a good first line management

strategy as it helps avoiding the rushed and unnecessary scarification of potentially surviving babies. Of course, the ultimate outcome of those ongoing USE and NRP will be a placenta accrete spectrum. [13-14]

E- Placenta accrete spectrum:

Placenta accrete spectrum (PAS) is a life threating, future fertility threatening and highly morbid complication of increased CS rates. It`s the natural consequence of surviving babies with USE and/or NRP treated expectantly.[14] However, still a large proportion of PAS cases are diagnosed later in pregnancy despite the fact that those embryos were implanted initially on the CS scar. Probably, adhering to the steps of prevention of uterine niche will results in prevention of niche related pregnancy and consequently will minimize the frequency of PAS. Necessarily, the prevention of needless CS will eliminate PAS for this category of women from practice.

F- Chronic pelvic pains:

Chronic pelvic pain is also a frequent post-operative complication, affecting ~20-40% of patients who have undergone surgery of the female genital problems. Chronic pain is an important risk factor for diminished quality of life after surgery. Adhesions are frequently associated with chronic post-operative pain; however, surgical treatment of adhesion-related pain is controversial.[15,16]

A- Post caesarean Captive cervix (PCCC):

One of the rare but annoying complications of CS is uterine adhesions to anterior abdominal wall. [17] In some cases, such adhesions result in marked elevation of the uterus and cervix with uterine fixity to anterior abdominal wall with subsequent PCCC. As a consequence of marked uterine elevation and fixation at a high up position the cervix becomes inaccessible or accessible with difficulty. Consequently, variable degrees of difficulties are experienced during subsequent cervical and/or transcervical diagnostic and therapeutic procedures. This problem is mostly results from one or more of the followings; over dissection, leaving large raw surfaces, harsh manipulation, serosa damage, dry towels mobbing, tissue dryness, upper segment extension, excessive suturing with undue forces in tying (those results in tissue cutting and re suturing with tissue devitalization and traumatization), infections and uterine exteriorization. In addition to its association with infertility

and pain, uterine adherence to anterior abdominal wall may upsurge morbidity at upcoming CSs and increases the needs for hysterectomy. [18]

Chronic pelvic pains (CPP) is another problem and after laparoscopic adhesion lysis or hysterectomy, patients with CPP noted a complete resolution of their CPP. Therefore, this type of adhesions that generate traction and fix the uterus to the abdominal wall subsequent to CS can be the cause of severe CPP.[18]

This annoying problem is totally preventable through omission of unindicated CSs and professional performance of the indicated ones.

Correction of PCCC surgical and could be accomplished by either laparoscopy or open microsurgery. Utero-lysis is a difficult job and risks bladder injuries.

Special advices and technical tricks for prevention of CS complication:

There is a bundle of actions to prevent most of the complications of CSs that requires subsequent MIS. This package of technical tricks is presented under two acronyms. To avoid redundancy those technical tricks are including the actions that should be done, which will be present later under the acronym of MAGIC CS and the actions to be avoided and will be presented under acronym of TRAGIC CS.

Treatment of existing post CS adhesions:

Post CS adhesins usually present with infertility and the severity of post CS adhesions is unpredictable and represent an important prognostic variable. Some authors classify their patients according to the severity of adhesions, into 4 groups mild type adhesions, moderate type adhesions, severe type adhesions and inoperable adhesion.

Laparoscopic lysis of adhesions is the technique of choice for managements of mild to moderate periadnexal adhesions after C.S. Pregnancy rates were found in their study on 1 year of postoperative followed up to be the highest for patients with mild adhesions 76.7%, followed by moderate adhesions 61.5%, and lastly patients with severe adhesions 20%. [7,8]

The role of open microsurgery for treatment of post CS adhesions is still there provided that adequate experience, appropriate patient selection and counseling are undertaken. In a study

undertaken to assess the effectiveness in pregnancy rates of microsurgery and operative laparoscopy in adhesiolysis, included microsurgery (86) or operative laparoscopy (104). The results indicated that advanced laparoscopic adhesiolysis is as effective as microsurgery in infertile patients with adhesions but offers some merits in contrast to laparotomy. They found that among the factors that unfavorably affect the postoperative success rates are the age of the women, the duration of infertility, and the severity of the adhesions.

However, the pregnancy outcome after adhesiolysis of severe periadnexal adhesions is poor. Accordingly, such patients are offered IVF treatment either directly after laparoscopy or after interval of expectant management according to the degree of restoration of normal pelvic anatomy and tubo-ovarian relation.

Summarizing acronym of MAGIC and TRAGIC CS.

To put things in a nutshell we presented two acronyms “the MAGIC-CS and the TRAGIC CSs’

The **MAGIC-CS** starts with **M**inimal, gentle and tissue respecting dissection this basic rule applies to all layers from the subcutaneous tissue the uterine incision. The values of this role are summarized in minimization of blood loss, keeping intact blood supply of the unnecessarily dissected tissues, promoting healing, decreasing the needs of hemostasis and tissue devitalization and decreasing the chances of infection of unreasonably opened devitalized tissue spaces.

Also, the **MAGIC-CS** is done through **A**dequate incision.

Incisional adequacy requires that both the abdominal wall and uterine incisions are just adequate to allow delivery of the fetal head without undue forces due to too small incisions. The value of incisional adequacy is to avoid excessive forces and maternal organs manipulations during fetal extraction. Also, adequate incision helps avoiding possible fetal trauma. it is needles to emphasis that larger than necessary incisions are not advised and may be a call for complications like inferior epigastric vessels excess blood loss injuries nerve damage poor healing and scaring.

In MAGIC-CS **G**ood and judicial hemostasis is required. Only significant bleeders and open-mouthed vessels should be secured appropriately. This is applicable for both abdominal wall and uterine incision. It`s imperative to emphasis that small gauged sutures (00or 000) on eyeless needles are better than larger gauged sutures and only the minimum coaptation force is used to secure the bleeders and the minimum number of stitches are used. Lager gauged sutures, undue forces of tying nots and excessive stitching compromises the blood supply of the tissues adjacent to the bleeder this would results in tissue devitalization, poor healing, scarring and niche development.

In MAGIC-CS the of implementation of all **I**nfection control measures is very important. Post CS infection can result in massive pelvic adhesions, Asherman's syndrome, frozen pelvises or specially when complicated by pelvic peritonitis, pelvic abscess and endometritis. Post-caesarean infections (PCI) result in substantial maternal morbidity and mortality in addition to increased readmissions and increased health care cost globally. Given the influence of PCI, it is imperative for health care providers to appreciate how to prevent, recognize and treat them. [19]

In MAGIC-CS the lower uterine segment (**LUS)** incision expansion is done in a **C**ephalad – **C**auded blunt extension in preference of sharp and transverse uterine incision expansion. The findings of a recent meta-analysis found that cephalad-caudad blunt expansion of the LUS incision is superior to transverse extension in relations to reducing unintended incision extension and uterine vessel damage. [20]

Critical appraisal of fetal head extraction had led us to do MAGIC CS with external pop out (EPO) technique. In the year 2017 we published our novel EPO technique for supporting the lower uterine segment during fetal head extraction in cesarean section (CS). Then 2 master Degree thesis were conducted in Assiut university hospital and came to the conclusions that EPO technique of fetal head delivery is easy to learn, acceptable to practicing obstetricians and associated with no major extension of the uterine incisions. Uterine incision extension is the mother of complications as it entails exteriorization of the uterus for repair which increases operative time, blood loss, tissue manipulation and tissues devitalization. Also, exteriorization of the uterus during extensions` repair results in tissue dryness, requires excess suturing and/or excess use of diathermy,

with subsequent poor healing, weak scar and higher possibilities of adhesions. Later MIS requirement is increased in order to manage such complications. Avoiding uterine incision extension through EPO technique for foetal head delivery during CS eliminates the needs for such MISs. [6]

Secure tension free closures during LUS incisional repair are one of the crucial steps in prevention of uterine niche. Security of closures means coaptation of the cut edges with the obstetrician paying attention to raw surface to raw surface closures. This means the proximal cut edge of the LUS incision is closed in opposition to the cut surface of the distal edge. Failure to obtain cut edge to cut edge closures will results in poor healing and weak scar. The use of the modest tension that`s just enough to allow tissue coaptation and approximation without compromising the peri incisional blood supply is one of important steps to allow perfect healing with strong scar. The use of small gauged sutures (no more than zero) on eyeless needles, taking good bite to good bite, equal bite to equal bite at equal distance between every two successive bites is fundamental for secure non adhesiogenic closures. [21]

The tragic CS starts with **T**raumatic dissection form the skin to the LUS incision with excessive tissue traumatization, devitalization creation of unnecessary spaces in the subcutaneous tissue, sub rectus dissection creation of large bladder flaps during the unnecessary step of bladder down dislocation. All unnecessarily done dissections are associated with prolonged operation time, excessive blood loss, excessive use of diathermy, compromising blood supply, tissue devitalization, postoperative pain, poor healing and excessive scaring, fibrosis with difficult subsequent surgeries. [22]

The tragic CS is characterized by **R**ough tissue manipulations either in the unnecessarily opened tissue plains or the healthy dissected tissues like the uterus, bladder, tubes, ovaries and pelvic peritoneum. An example of rough tissue manipulation is the dry towel toilets that results in serosa abrasion with subsequent tubo-ovarian adhesion. Also, the unjustified exteriorizations of the uterus that might subject the uterus to serosal abrasion or damages specially when exteriorization was done through inadequate abdominal wall incision or through a scared stiff tissue due to

previous surgeries. One of the valuable advices coated by our great professors Shaaban M to combat both undesirable techniques of dry towels introduction into the peritoneal cavity and exteriorization of the uterus he said: “nothing in and nothing out”

The tragic CS is associated by several **A**dhesiogenic attitudes beside the aforementioned pitfalls. Excessive and unjustified use of diathermy on the expense of tissue respecting techniques like wet towel compression. In addition, during closures of uterine and other incisions, the use of excessive suturing with locking and undue traction on continuous suture compromises vitality of tissues with poor healing and subsequent scaring. The use of unnecessarily large suture gauges or excessive forces on suture brings about devitalization of tissues during repair we need suture gauge and force that results in tissue approximation rather strangulation. One of the observed adhesiogenic techniques was the undue forces on tying the sutures` knots and excessive traction on traction the continuous suture up to tissue cutting by the sutures with a vicious circle of repeating suturing, excess tissue devitalization, poor healing and subsequent adhesion formation.

Generous hemostasis attitudes (GHA) during tragic CS as result of poor professional understanding of the great value of enhanced coagulation system during pregnancy. The overdone GHA entails excessive use of diathermy or excessive strangulating suturing with subsequent tissue thermal or vascular devitalization, poor healing, predisposition to infection and subsequent fibrosis and adhesions. It`s important to mention that unnecessary cauterization of every oozing point that results in deprivation of the blood supply is result of professional unawareness of the enhanced coagulation process during pregnancy that can control such ooze by tissue friendly actions.

Failure of **I**nfection control bring about the possibility of infection, pelvic abscess and vigorous adhesions. Increased maternal age, not receiving antibiotics prophylaxis, higher number of per vaginal examination, having a history of chorioamnionitis, having previous history of CS, preoperative anemia, and longer duration of rupture of membrane were significant factors in post CS infection. Therefore; emphasis should be given for mothers who have higher age category, previous cesarean scar and history of choriamnionitis. In addition; provision of antibiotics should be comprehensive for all mothers undergoing cesarean section.

Tissue **I**rrigation by saline was found in our experience and from our point of view to be more physiologic, and tissue friendly. Its practical use denoted that irrigation is effective and better than the use of towels in many aspects, namely, better removal of blood, amniotic fluid and debris through repeat irrigation and suction. Tissue irrigation keeps the irrigated tissues wet, vital and helps keeping the integrity of the covering epithelium and safeguard against the tissue dryness and abrasions that trigger adhesion formation.

Lastly, the tragic CS relies on the **C**lassic way of fetal head delivery that entails introduction of the obstetricians` hands or fingers into the lower uterine segment increasing the chances of uterine incisions` extensions as well as increasing the theoretical risk of infection. An extension of the uterine incision is considered the mother of complications because it requires exteriorization of the uterus, prolongs the operative time, increases the blood loss, increases the chance of infection as well as increasing the needs for excessive dissection and excessive suturing with subsequent tissue devitalization, poor healing and adhesions.[6]

The **TRAGIC** CS acronym summarises a group of pitfalls that marks that CS technique bad, complication calling, subsequent MIS demanding for, cost burdening and associated with patient dissatisfying outcomes. This acronym starts with **T**raumatic dissection, **R**ough tissue manipulations, **A**dhesiogenic attitudes, and passing through **G**enerous hemostasis strategies, in addition to failure of **I**nfection control, missing tissue **I**rrigation and lastly resorting to the **C**lassic way of fetal head delivery.

Paying attention to and avoiding those pitfalls just mentioned in the aforementioned acronymic summary, this will convert a TRAGIC CS into a MAGIC CS. The MAGIC-CS represent another acronymic summary of a group of good conducts during CS that make procedure good, with shorter operative time, minimal blood loss, complications free, patients satisfying, medical resources protective and drying the wide channels of subsequent MIS demands.

The **MAGIC-CS** starts with **M**inimal, gentle and tissue respecting dissection, **A**dequate incision, **G**ood and judicial hemostasis, **I**nfection control, **C**ephalad – **C**auded blunt extension of uterine incision, with **C**ritical appraisal of fetal head extraction and lastly **S**ecure tension free closures.

Conclusions:

On the face of increasing rates of CS and its complications, prevention of unnecessary CS is the striving goal and should a priority for policy makers media and health care professionals. Until achieving this ultimate goal obstetricians should adhere to the steps of the MAGIC CS and avoid the pitfalls listed in the TRAGIC CS to prevent the adhesions, uterine scar niche and other CS` complication that requires subsequent MIS.

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