INTRODUCTION

Cesarean delivery is the most common and major obstetric operative procedure worldwide and cesarean rate has been continuously increased ***(Cunningham et al., 2010).***

Cesarean section is defined as the surgical termination of pregnancy or delivery by operative opening of uterus ***(Lurie, 2005).***

The cesarean section was first described in Roman times (Lurie, 2005). But only at the start of the 20th century did it begin to offer acceptable morbidity and mortality for both mother and baby ***(ICHS, 2008).***

This procedure has different techniques to minimize morbidity and to reduce its complications ***(Rodriguez et al., 1994).***

The main aspects of the surgical approach to low-transverse cesarean delivery have not changed much since it was first described by Kerr in 1926 (Kerr, 1926). However, these techniques are individually performed based on clinical recommendation without evidenced base ***(Rodriguez et al., 1994).***

Over 90% of cesarean deliveries performed at the lower uterine segment because it is easier to enter the uterine cavity with lesser blood loss comparing with vertical incision ***(Rodriguez et al., 1994).***

Extension of the uterine incision at cesarean delivery usually is performed either sharply by cutting laterally and then slightly upward with bandage scissors or bluntly by tearing the myometrium with the fingers ***(Rodriguez et al., 1994 and Magann et al., 2002).***

Sharp expansion was significantly increase risk of intra-operative and postpartum hemorrhage ***(Rodriguez et al., 1994)*** while blunt expansion is faster and causes lesser myometrial bleeding from its edges ***(Pelosi et al., 2004).***

Anatomic studies indicate that the oblique interlacing muscular fibers of the middle layer of the myometrium in the body of the uterus assume a horizontal course inferiorly towards the isthmus ***(Young, 2007).*** Thus, because circular and transversely running muscular bundles dominate the lower uterine segment, uterine incision can be widened transversally by separation of the index fingers of the surgeon in the midline and in a cephalad-caudad direction as well ***(Pelosi et al., 2004).***

Blunt separation can be either transversely or in cephalad-caudad direction. Scientists have stated that the expansion in the transverse direction could cause sacculation-type defect of uterine wall and increase risk of repeated cesarean section ***(Young, 2007)***.Alternatively, it was speculated that expansion of uterine incision with a vertical traction might have 2 potential advantages. The first is to avoid greater forward extension of the distal incision because of lack of

control of the force magnitude that is applied by the surgeon's fingers at the lateral edges of the incision. The second is to minimize tissue trauma by allowing myometrium dissection along natural tissue planes ***(Clark, 1995 and Abuhamad et al., 1992).***

Therefore we will conduct a study to compare 2 methods of expanding the uterine incision (blunt extension by separating the fingers in a transversal vs cephalad-caudad direction) at the time of cesarean delivery as regards unintended extension of the uterine incision primarily and blood loss as a secondary outcome.

AIM OF THE WORK

The aim of the current work is to compare two different techniques of blunt expansion of the low transverse uterine incision at cesarean delivery; Cephalad-caudad and transverse expansion as regards the incidence of unintended uterine extension as a primary outcome and amount of blood loss as secondary outcome.

Research hypothesis: The cephalad-caudad expansion technique may be better and may have less complications than transversal expansion technique in cesarean delivery as regards the uterine vessels injury primarily and unintended extension , blood loss and need for additional stitches as secondary outcomes.

Research question: *Is the blunt expansion of the uterine incision using the* cephalad-caudad technique better than using the transverse technique regarding uterine vessels injury, unintended extension, blood loss and the need for additional stitches.

CESAREAN SECTION

A C-section, also called a cesarean section, is the delivery of a baby through a surgical abdominal incision ***(Althabe et al., 2006).***

It represents the most significant operative intervention in all of obstetrics. Its development and application has saved the lives of countless mothers and infants. On the other hand, its inappropriate use can be a direct and avoidable cause of maternal mortality and morbidity ***(Althabe et al., 2006).***

For these reasons, cesarean section probably represents the largest source of controversy and debate in modern obstetrics. The frequency with which it is carried out continues to rise; the incidence of cesarean section in UK National Health Service hospitals was almost 6%.It would now be difficult to find many such hospitals with a rate less than 15% and figures of 30% or more are not unknown. Some national cesarean section delivery rates even exceed 30% ***(Althabe et al., 2006).***

Historical Background

Cesarean section is almost certainly one of the oldest operations in surgery with its origin lost in the mists of antiquity and mythology as historians are accustomed to say when they don't know. It has probably been performed by traumatic accident or postmortem for several millennia ***(Cunningham et al., 2002).***

The origin of the word cesarean is unclear. **J.H Young** in his monogragh of "The history of cesarean section" published in 1944 reached a conclusion that "it is quite impossible to asbertain exactly when the operation of cesarean section was first performed, whether on a living woman or postmortem. There is no doubt however, that the history of cesarean section is of great antiquity. Though the earliest medical writers are silent on the subject of cesarean section, yet unmistakable references are made to it in ancient rabbinicial writings such as the mischnagoth (140 B.C.) and the Talmud, compiled between second and sixth century AD. If cesarean section was actually employed, it is particularly surprising that Soranus, whose extensive work written in the second century AD covered all aspects of obstetrics, did not refer to cesarean section ***(Cunningham et al., 2002).***

The weak myth that Jelius Caesar was born by this route is contradicted by the fact that his mother survived his birth by many years. It is likely that the term comes from the Lex Regia or royal law legislated by one of the early kings of Rome, Numa Pompilius in 715 BC. This law proclaimed that women who died before delivering their infants had to have the infant removed through the abdomen before burial. Later in the time of the Cesars, this law was called Lex Caesarea, and this is the most probable derivation of its present name ***(Fassbender, 1906).***

A linguistic explanation states that the word cesarean was derived sometime in the Middle Ages from the Latin verb Caedera "to cut". An obvious cognate is the word caesura, acutting, or pause, in a line of verse. This explanation of the term cesarean seems most logic, but exactly when was it first applied to the operation is uncertain. Because "section" is derived from the Latin verb seco, which also means "cut" the term cesarean section seems tautological ***(Cunningham et al., 2002).***

Cesarean section on the living was first recommended, and the current name of the operation used, in the collaborated work of **Francois Rousset** in1581 entitled 'Traite Nouveau de l'hystrotomotokieoul'enfantement cesarien". Rousset had never performed or witnessed the operation; his information was based chiefly on letters from friends. He reported 14 successful cesarean sections, a fact itself difficult to accept. When it is further stated that 6 of the 14 operations were performed on the same woman, the credulity of the most gullible is exhausted ***(Cunningham et al., 2002).*** However, it was not until the pioneering work of Morton in the use of diethylether for operative anaesthesia in 1846 and the introduction of carbolic acid antisepsis of listersome 20 years later that cesarean delivery could begin to be approached in a uniform manner as a potential option for childbirth ***(Sewell and Washington, 1993).***

The first witnessed and documented cesarean section by a physician was performed by Jeremias Trautmam in Wittenberg, Germany in 1610. However, a number of obstetric texts in the 16^{th} and 17^{th} centuries described the rare

performance of cesarean section in cases of contarcted pelvis. From the 16th to the 18th centuries the prevailing medical wisdom was strongly against cesarean section, with its almost inevitable fatal outcome for mother ***(Young, 1944).***

The reasons for the high mortality in the pre-anesthetic era was that cesarean sections were usually performed after prolonged labor on women who were dehydrated, exhausted and infected. In addition, after removal of the fetus the uterus was not sutured, adding hemorrhage to the mortality equation. In addition to hemorrhage, sepsis was the commonest cause of death ***(Fassbender, 1906).***

Early success in cesarean section was further compromised by the widespread belief that once incised, uterine muscle could not be safely sutured, principally out of fear of infection. Against this background, a series of 22 cesarean deliveries performed in Paris prior to 1876 demonstrated a 100% maternal mortality, mostly due to infection or hemorrhage ***(Sewell and Washington, 1993).***

The first successful cesarean delivery in the British Empire was performed between 1815 and 1821 ***(Miller, 1992).***

The first major surgical advance in the technique of cesarean section was introduced in (1876) by **Porro** ***(Miller, 1992).*** Influenced by the prevailing concept of non-suturing of uterine incisions, **Porro** introduced a technique in which the uterine fundus was amputated following hystrotomy and the stump marsupialized to the anterior abdominal wall. Although

drastic by today's standard, the Porro technique resulted in dramatic decline in maternal mortality associated with this operative abdominal delivery ***(Spreet, 1958).***

Throughout most of the 19th century cesarean section was seen as an operation of last resort, the concept that maternal outcome might be improved by earlier intervention prior to fetal death or maternal infection was initially proposed by **Dr. Robert Harris** of Philadelphia. In 1887, Harris published a series of nine women "delivered" by being gored "bybulls" and 12 women delivered by standard cesarean section. The observation of a 55% maternal survival in the gored group compared to an 8% survival in those surgically delivered led Harris to conclude "a far better for the cow-horn than the knife" ***(Cunningham et al., 2002).***

The turning point in the elevation of cesarean section came in 1882 when Max Sanger, then a 28-years old assistant of Crede in the university clinic at Leipzig, introduced suturing of the uterine wall. The long neglect of so simple an expedient step as uterine suture was not the result of oversight but stemmed from deeply rooted belief that sutures in the uterus were dangerous as well as harmful by virtue of serving as the site for severe infection ***(Cunningham et al., 2002).***

In meeting these objections, Sanger, who had himself used sutures in only one case, documented their value, not from the sophisticated medical centers of Europe but from frontier America. There, in outpost of Ohio to Louisiana, 17 cesarean sections had been reported in which silver wire sutures had

been used, with the survival of 8 mothers, an extraordinary record in those days. In a table enclosed in his monogragh, Sanger gave full credit for these frontier surgeons for providing the supporting data for this hypothesis ***(Cunningham et al., 2002).***

Although the introduction of uterine sutures reduced the mortality rate of the operation from hemorrhage, generalized peritonitis remained the dominant cause of death; hence, various types of operations were derived to combat this scourge ***(Cunningham et al., 2002).***

Nevertheless, Porro operation remained popular for many years and in one series from Eastern United states in 1992, 25% of cesarean sections were performed as Porro cesarean hysterectomies ***(Harris, 1992).***

Frank Polin (1825) was the first American physician credited with the use of sutures to close the uterus after cesarean delivery, he used silver wire sutures.The next major development in cesarean section was Frank's description in 1907 of extra-peritoneal cesarean section ***(Frank et al., 1907).*** Frank opened the peritoneal cavity first above the pubis and then sutured the parietal peritoneum to the visceral peritoneum at the point of the visico-uterine reflection. This sealed off the peritoneal cavity before opening the uterus through a vertical incision ***(Sewell and Washington, 1993).***

Two years later, **Latzko** reported a major modification of the procedure, which avoided entry into peritoneal cavity. The

extra-peritoneal operation designed to prevent the peritoneal contamination that occurred once the uterus was opened ***(Latzko, 1999).***

In 1912, **Kronig** used a transperitoneal approach, dissected the bladder away from the lower uterine segment, and entered the uterus through a short vertical incision ***(Larry et al., 2002).***

In the early 1920s, **Beck, De lee and Comell** popularized the vertical lower segment operation in the United States ***(Beck, 1921).***

It was Munro Kerr who would be largely responsible for the great change from the classical incision to the low transverse incision. When Kerr performed his downward curving transverse incision on the lower uterine segment, it was to reduce and contain the risk of sepsis ***(Kerr, 1926).*** This was modified by **Pfaneuf in1931** into the present day, upward curving low transverse uterine incision ***(Cunningham et al., 2002).***

It was until 1949, however, at the 12th British Congress of Obstetricians and Gynecologists, that Kerr finally noted general acceptance of his procedure. Raising his arms over his head, heproclaimed *Allelujah*, the strife is over, the battle done" ***(Kerr, 1926).***

The Kerr's procedure now is the most popular type of cesarean section ***(O'Sullivan et al., 1981).***

In the late of 1980s and 1990s, one layer suturing the uterus and pelvic peritoneal non closure were also advocated. The first evaluation of these modifications was described by **Michael Stark** and colleagues in 1995, using a technique that took the name of the hospital that most contributed to its development, the Misgav-Ladach ***(Xavier et al., 2005).***

Incidence of Cesarean Section

Due to the absence of accurate statistics on the numbers of the cesarean delivery in Egypt especially in the early years of the 20th centaury, we will use the statistics from the United states to give an idea about the changes in the frequency of performing cesarean delivery.From 1910-1928, the cesarean delivery rate at Chicago Lying-in Hospital increased from 0.6% to 3%. The cesarean delivery rate in the United States was 4.5% in 1965. According to the National Hospital Discharge Survey, the cesarean rate rose from 5.5% in 1970 to 24.1% in 1986. Fewer than 10% of mothers had a vaginal birth after a prior cesarean, and women spent an average of 5 days in the hospital for a cesarean delivery and only 2.6 days for a vaginal delivery ***(Placek and Taffel, 1988)***

It was predicted that if age-specific cesarean rates continued at the steady pattern of increase observed since 1970, 40% of births would be by cesarean in the year 2000. Those

predictions fell short, but not by much. The National Centre for Health Statistics reported that the percentage of cesarean births in the United States increased from 20.7% in 1996 to 32% in 2007 ***(NCHS data brief, 2010).***

Cesarean rates increased for women of all ages, races, ethnic groups, and gestational ages and in all states.Both primary and repeat cesareans increased. Increases in the primary cesareans with no specified indication were faster than in the overall population appear to be the result of changes in obstetric practice rather than changes in the medical risk profile or increases in maternal request ***(MacDorman et al., 2008).***

This has occurred despite several studies that note an increased risk for neonatal and maternal mortality for all cesarean deliveries as well as for medically elective cesareans compared with vaginal births. The decrease in total and repeat cesarean delivery rates noted between 1990 and 2000 was due to a transient increase in the rate of vaginal births after cesarean delivery ***(Harper et al., 2003).***

The cesarean delivery rate has also increased throughout the world, but rates in certain parts of the world are still substantially lower than in the United States. The cesarean delivery rate is approximately 21.1% for the most developed

regions of the globe, 14.3% for the less developed regions, and 2% for the least developed regions ***(Betrán et al., 2007).***

In a 2006 publication reviewing cesarean delivery rates in South America, the median rate was 33% with rates fluctuating between 28% and 75% depending on public service versus a private provider. The authors conclude that higher rates of cesarean delivery do not necessarily indicate better perinatal care and can be associated with harm ***(Villar et al., 2006).***

Why the rate of cesarean delivery has increased so dramatically in the United States is not entirely clear. Some reasons that may account for the increase are repeat cesarean delivery, delay in childbirth and reduced parity, decrease in the rate of vaginal breech delivery, decreased perinatal mortality with cesarean delivery, nonreassuring fetal heart rate testing, and fear of malpractice litigation, as described in the following paragraphs ***(Hamilton et al., 2004).***

In 1988, when the cesarean delivery rate peaked at 24.7%, 36.3% (351,000) of all cesarean deliveries were repeat procedures. Although reports concerning the safety of allowing vaginal birth after a cesarean delivery had been present since the 1960sby 1987, fewer than 10% of women with a prior cesarean delivery were attempting a vaginal delivery ***(Cho et al., 1994).***

In 2003, the repeat cesarean delivery rate for all women was 89.4%; the rate for low-risk women was 88.7%. Today, low-risk women giving birth for the first time who have a cesarean delivery are more likely to have a subsequent cesarean delivery ***(Menacker, 2005).***

In the past decade, an increase in the percentage of births to women aged 30-50 years has occurred despite a decrease in their relative size within the population. The cesarean rate for mothers aged 40-54 years in 2007 was more than twice the cesarean rate for mothers younger than 20 years (48% and 23%, respectively). The risk of having a cesarean delivery is higher in nulliparous patients, and, with increasing maternal age, the risk for cesarean delivery is increased secondary to medical complications such as diabetes and preeclampsia ***(Hamilton et al., 2010).***