REVIEW ARTICLE http://doi.org/10.3126/njr.v13i2.59964

Intracardiac KCI Injection in Cesarean Scar Pregnancy: A Review Article

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Received: September 25, 2023 **Accepted:** November 10, 2023 **Published:** November 24, 2023

Cite this paper:
Gupta A, Thapa M. Intracardiac KCl injection in cesarean scar pregnancy: A Review Article. *Nepalese Journal of Radiology* 2023;13(2):3-8. **http://doi.org/10.3126/njr.v13i2.59964**

ABSTRACT

Embryo implantation in a previous caesarean scar (CS) resulting in a caesarean scar pregnancy (CSP) is another rare but potentially catastrophic complication of a previous caesarean birth. CSP can be detected between days 33 and 94 of pregnancy. Methotrexate and potassium chloride (KCl) are the most common feticidal agents used. intracardiac KCl causes feticide and reduces the uteroplacental blood flow, thereby decreasing the rate of hemorrhage due to placenta previa, caesarian scar pregnancy and in cases of fibroids; it is easy to evacuate the macerated fetus. Intracardiac KCl causes feticide and reduces the uteroplacental blood flow, thereby decreasing the rate of hemorrhage and abortion time before termination of pregnancy (TOP) leading to an easy evacuation of the macerated fetus. In conclusion, feticide with intracardiac KCl is a safe procedure.

Keywords: *Cicatrix; Leiomyoma; Methotrexate; Potassium Chloride; Pregnancy*

INTRODUCTION

Cesarean scar pregnancy is defined as an ectopic pregnancy embedded in the myometrium of a previous Cesarean scar. The first case of CSP was reported in 1978 by Larsen and Solomon. The first detection of a 7-week cesarean scar pregnancy made in transvaginal US occurred in 1990. Studies indicate that CSP can be detected between days 33 and 94 of pregnancy. The incidence of CSP has been estimated to range from 1/1800-1/2500 of all CD performed and 1/531 for women who had at least one cesarean delivery. To date there have been only a few randomized studies on CSP and evidence-based management remains unclear. Until then, treatment should be individualized according to many factors including clinical presentation, β-hCG levels, imaging features, and patient choice. In IR, the local treatment is widely used for termination of pregnancy using MTX as the most common feticidal agent or other agents such as potassium chloride, ethanol and hyperosmolar glucose.[1,2,3,4,5,6,7]

The technique of intracardiac KCl to induce fetal demise is well established.[27] Intracardiac KCl is frequently used for fetal reduction in multiple pregnancies. Its use to induce fetal demise to reduce hemorrhage in medical termination of pregnancy is not very frequent, however, intracardiac KCl causes feticide and reduces the uteroplacental bl

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flow, thereby decreasing the rate of hemorrhage due to placenta previa, caesarian scar pregnancy and in cases of fibroids; it is easy to evacuate the macerated fetus.

METHODS

We searched MEDLINE/PubMed electronic database using medical subheading search words such as 'caesarean scar pregnancy'; 'caesarean scar'; 'caesarean scar local management';

'caesarean scar minimally invasive management'; 'ectopic pregnancy'; 'caesarean scar ectopic pregnancy'; 'pregnancy, previous caesarean scar'; and 'unusual ectopic pregnancies' to obtain a comprehensive list of articles concerning this condition from January 1978 to March 2021. We also searched using the 'Scholar Google' search engine on the internet (www.scholar.google.com) for articles on this topic since 1987. The citations were cross-checked via related articles and links in PubMed. Additional articles were obtained from the cross-references of the relevant publications for bibliographical purposes.

Predisposing factors, mechanism and pathophysiology

The exact cause and mechanism is not well understood but it is possible that the conceptus penetrates the myometrium through a microscopic dehiscent tract of the cesarean scar or the gestational sac implantation occurs in a poorly healed cesarean section scar. Such a tract can also develop from the trauma of other uterine surgery, e.g. curettage, myomectomy, metroplasty, hysteroscopy and even manual removal of placenta. In CSP, the gestation sac is surrounded by myometrium and the fibrous tissue of the scar, quite separate from the endometrial cavity. Cesarean delivery is associated with increased risks of placenta previa, uterine rupture and placenta accreta. Among women with placenta previa and a previous cesarean section, the risk of placenta accreta was significantly higher when the placenta was implanted over the scar, supporting the theory that trophoblast adherence or invasion is enhanced when the scant decidualization of the lower uterine segment is further impaired by previous myometrial disruption.[8,9,10,11,12]

Types of CSP

There are two types of cesarean scar pregnancy proposed by Vial et al. CSP directed towards cervicoisthmic space or uterine cavity (type I, endogenic type) and CSP with a deep invasion of scar defect with progression towards the bladder and abdominal cavity (type II, exogenic type). The endogenic type of CSP could result in a viable pregnancy; yet with a high risk of bleeding at the placental site.[13,14]

Presentation

The symptoms can be seen from 5-6 weeks and as late as 16 weeks. Mild vaginal bleeding is the presenting symptom in 39% and approximately 16% complain of associated mild to moderate pain and 9% complain of only abdominal pain.[15,16,17]

Imaging

Ultrasound

It is the primary diagnostic tool for cesarean scar and pregnancy The advent of TVUS has made it possible to diagnose ectopic pregnancies at earlier gestational ages, reducing the risk of significant morbidity and mortality. The early diagnosis of CSP at approximately 6 weeks of gestation and as late as 16 weeks of gestation enables non-surgical treatment, resulting in short-term hospitalisation and preserving fertility. Early correct CSP diagnosis increases confidence and implementation of minimally invasive surgery.[18]

The following criteria have been followed for diagnosis of CSP:[5,19,20,21]

An empty uterine cavity and endocervical canal.

Gestational sac located within the anterior myometrium of previous cesarean scar site in LUS.

Color Doppler flow around the sac is characterized by a high velocity (peak velocity 0.20 cm/s) and low impedance (pulsatility index,1) blood flow;

Negative 'sliding organs sign', that is inability to displace the gestational sac from its position at the level of the internal os using gentle pressure applied by the transvaginal probe.

less than 5mm of myometrium or scar tissue

separating the sac from the bladder

In most of the cases, less than 5mm thickness of myometrium between the gestational sac and bladder has been reported.[22]

It can also help to detect placenta accreta spectrum i.e. placenta or gestational sac embedded in the hysterotomy scar.

Non-visualisation of myometrium between the urinary bladder and sac can also help in differentiation from cervicoisthmic pregnancy.[8]

In spontaneous abortion, the avascular gestational sac should be seen in the cervical canal on TVS, indicating detachment of sac from its implantation site, whereas in caesarean scar pregnancies, the gestational sac would appear well-perfused and would be located in the anterior uterine wall at the isthmus.[23]

Magnetic resonance imaging

MRI imaging can be an added advantage in equivocal cases for gestational sac location confirmation and surrounding organs. MRI and TVS are equally accurate in the diagnosis of CSP but scar implantation can be better evaluated with it. MRI T2-weighed sagittal section was used to identify the cesarean scar defect, trophoblastic layer, and myometrium separately. The MRI findings of cesarean scar pregnancy are the same as above mentioned sonographic findings concepts implantation on cesarean section scar, myometrial defect in association with empty endometrial cavity and placenta accreta spectrum.[14,24,25]

Technique

At least half an hour before the feticide procedure, all the patients were given pethidine 50 mg intravenously for sedation and an anti-emetic if necessary. After excluding allergies, a second-generation cephalosporin (mefoxin) 2gm was given intravenously as a prophylactic antibiotic. Lignocaine 2% was used to infiltrate the maternal abdominal skin at the site of entry into the fetal heart. A 20-gauge 15cm spinal needle was traversed through the predetermined tract, targeting the left ventricle or the most accessible chamber of the fetal heart. To reduce the risk of feto-maternal contamination through the needle tract during insertion, the initial 1 ml of aspirated heart blood was discarded. Thereafter, 2ml of 15% KCl was injected into the fetal heart under direct vision. A further 2ml was injected every 30 seconds until permanent fetal asystole was achieved, and the time was recorded. The fetal heart was observed on scan for a further 5 minutes of asystole with the needle in situ. To minimise any risk of maternal contamination with KCl, the needle was flushed with 5ml sterile water or saline before removal. Provided there were no contraindications to vaginal delivery, the women were given the choice to have labour induced or to await spontaneous onset of labour. Labour was induced if women did not go into spontaneous labour within 3 weeks.[26]

Treatment

Because of the rarity of the condition, the majority of CSPs are case reports or small case series reported in the literature, with no consensus on the preferred mode of treatment. Generally, termination of pregnancy (TOP) in the first trimester is strongly recommended, as there is a high risk of subsequent uterine rupture, massive bleeding and life-threatening complications. This, in turn, may warrant life-saving hysterectomy and loss of future fertility.

There are following types of CSP intervention

- KCl only
- KCl + MTX
- MTX only
- Expectant

Intracardiac potassium chloride (KCl) was first described as a method for inducing fetal demise in 1988 and has since grown in use to induce feticide before an abortion, by either intracardiac or umbilical vein administration. Post-KCl administration causes fetal asystole by disrupting the balance of intra- and extracellular potassium, which subsequently decreases myocyte action potential. As a result of this in-induced demise, the fetal tissue becomes macerated and softened, mimicking a spontaneous fetal demise, and thereby theoretically resulting in an easier surgical procedure.[28,29]

There are very few studies and case reports where fetal demise is induced with intracardiac KCl before medical TOP to reduce the risk of hemorrhage either because of placenta previa or ectopic pregnancy at the scar site or due to large fibroids distorting the uterine anatomy.

According to Kaur et al., an average of 1.8cc of intracardiac KCl was required to achieve cardiac asystole which is less as compared to other studies. This is because the gestational age was less (10+4 weeks to 19 weeks) in our study as compared to a study by Sfakianaki et al. (range, 15.4-24.9 weeks) where on an average of 10 mL of strong KCl was required to reliably achieve fetal cardiac asystole.[30,31]

Another study showed the average amount of potassium chloride required in their study was 4.7ml (range 2–10 ml), much less than the amounts reported by other authors. If the needle is correctly positioned in the left ventricle, a minimal amount of potassium chloride is required to achieve asystole as the potassium chloride is injected rapidly into the coronary circulation inducing immediate asystole.[32]

The data shows that it is safe to use up to 20 mL of 15% KCl by the intracardiac route, but that on average only 10 mL of strong KCl is required to reliably achieve fetal cardiac asystole.[33]

The role of intracardiac KCl is to reduce the blood flow and thus the risk of hemorrhage or to reduce abortion time either in terms of conservative abortion or dilatation and curettage. According to Tufa et al., and Lohr et al., Inducing fetal demise with intracardiac KCl is associated with a decrease in D&E procedure duration or conservative management duration.[34,35]

Uterine artery embolization has also been used in previous studies to manage scar pregnancy but uterine artery embolization is a more invasive procedure with a longer duration than intracardiac KCl.[36]

CONCLUSION

Embryo implantation in the region of a previous caesarean section scar is a rare but potentially catastrophic complication of a previous caesarean birth. The exponential rise in its incidence during the past 5-6 years may be a true increase in incidence because of the rising caesarean section rate worldwide or an apparent increase as a result of a more liberal use of TVS in early pregnancy. Little is known about its exact mechanism and natural history.

In conclusion, feticide with intracardiac KCl is a safe procedure and reduces the risk of hemorrhage and abortion time before TOP in scar pregnancy.

CONFLICT OF INTEREST

None

SOURCES OF FUNDING

None

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