

Review Acute inversion of the uterus

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Key content:

- Acute uterine inversion is a rare and unpredictable obstetric emergency.
- Mortality and morbidity are reduced by early recognition and management.
- Shock and uterine replacement must be addressed simultaneously.
- The importance of teamwork cannot be overemphasised.
- There is a need for skills and drills training because of the rarity of acute inversion.

Learning objectives:

- To understand the pathophysiology.
- To understand and to be able to evaluate critically the general management principles.

Ethical issues:

- Management of uterine inversion is guided by a relatively small evidence base, resulting in treatment modalities being used without proper evaluation.

Keywords manual replacement / postpartum haemorrhage / surgical management / tocolysis

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Introduction

Hippocrates (c. 460–377 BC)¹ mentioned uterine inversion, as did Soranus of Ephesus in AD 110,² but it was not until the 16th century, during the time of Ambroise-Paré, that it was understood.^{3,4} Uterine inversion is defined as ‘the turning inside out of the fundus into the uterine cavity’. Acute inversion is a rare and serious obstetric emergency. Women can sink into profound shock which can prove fatal. Immediate management of shock and manual repositioning of the uterus both reduce morbidity and mortality.

Incidence and mortality

As with any obstetric complication, the likelihood of a woman of having acute inversion depends on geographic location; for example, the incidence is three times higher in India than in the USA.⁵ Baskett *et al.*⁶ analysed data in a North American unit over 24 years and noted a four-fold decrease in the incidence of acute uterine inversion associated with vaginal birth after the introduction of active management of the third stage, from 1 in 2304 to 1 in 10 044. The perception amongst many obstetricians is that uterine inversion is very rare: it will occur only once in a decade in most British maternity units (approximately 1:27 902 births).⁷ Baskett *et al.*,⁶ however, reported the incidence as 1:3737, which would suggest occurrence at least once a year in most units. As it is expected that more women in the UK will be delivered in the community in the future, theoretically, there could be an increase in the incidence of uterine inversion, as these women are more likely to have physiological management of the third stage. Moreover, time will be spent transferring the women to hospital if any problems arise. There is, therefore, a need for training in the management of acute uterine inversion in all settings and it should be a part of routine skills and drills teaching.

Before modern management, mortality rates following acute uterine inversion were reported to

have been as high as 80%.¹⁸ Abouleish *et al.*⁹ and Platt *et al.*,¹⁰ however, reported no associated maternal mortality in a study of 18 and 28 cases of acute uterine inversion from two university-affiliated maternity units. In our opinion, the mortality need not be as high as quoted, especially in developed nations with appropriate management techniques.

Aetiology

It is well established that mismanagement of the third stage of labour (premature traction on umbilical cord and fundal pressure before separation of placenta) is the commonest cause of acute uterine inversion. This can happen when delivery is conducted by an untrained accoucheur, a situation more likely to occur in developing countries, which explains why the incidence in India is treble that of the UK. Many other risk factors have been cited, including uterine atony, fundal implantation of a morbidly adherent placenta, manual removal of the placenta, precipitate labour, a short umbilical cord, placenta praevia and connective tissue disorders (Marfan syndrome, Ehlers-Danlos syndrome).^{5,6,11–17} It must be emphasised, however, that, in up to 50% of cases, no risk factors are identified⁹ and there is no mismanagement of the third stage. This condition can, therefore, be unpredictable.

Pathophysiology

There are three possible events that explain the pathophysiology of acute uterine inversion:¹⁸

- a portion of uterine wall prolapses through the dilated cervix or indents forward
- relaxation of part of the uterine wall
- simultaneous downward traction on the fundus leading to inversion of the uterus.

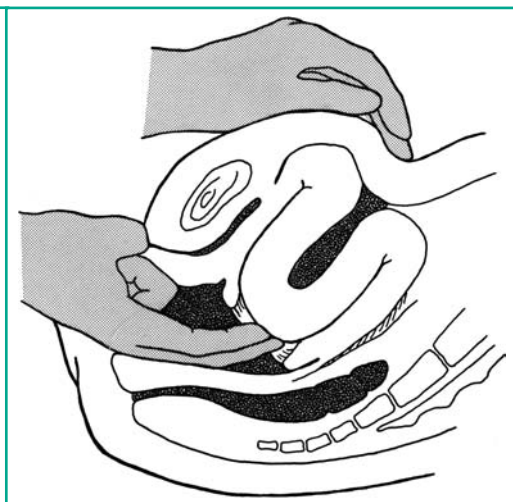
Classification

Various classification schemes describe uterine inversion. For simplicity we categorise uterine inversion by severity, as shown in **Box 1**.^{16,18–23}

Clinical presentation and differential diagnosis

(See **Box 2**, **Box 3** and **Figure 1**) The vast majority of cases (94%) present with haemorrhage, with or without shock. It should be noted that, initially, shock may be neurogenic with signs of bradycardia and hypotension but, with time, postpartum haemorrhage will ensue. In a study of 28 cases, Platt *et al.*¹⁰ described a lower incidence of shock and haemorrhage (28.5%): this was credited to awareness, early recognition and appropriate intervention at their hospital. Therefore, a high index of suspicion where shock is out of proportion to blood loss can help in making an early diagnosis and avoiding haemorrhage.^{23–26} Those conditions

Figure 1
Incomplete uterine inversion can be diagnosed by manual examination. (Drawn by and reproduced with the kind permission of Bryony Cohen, Medical Illustration Department, St Bartholomew's Hospital, London, UK)



presenting with a lump in the vagina or causing postpartum collapse need to be excluded.

Management

The key to a successful outcome is teamwork, as resuscitation and repositioning of the uterus have to be undertaken simultaneously. The overall management of acute uterine inversion is outlined in an algorithm (Figure 2).

Treatment of shock

The basic principles of resuscitation are well established and should follow the pattern of a postpartum haemorrhage drill. The quickest way to treat neurogenic shock, however, is to replace the uterus.^{26,27}

Nonsurgical management

Manual replacement

Once the diagnosis is made, uterine replacement should be attempted promptly. This is best done manually, as delay can render replacement progressively more difficult and increase the risk of haemorrhage. In 1949, AB Johnson described the procedure commonly used for manual replacement of the uterus, now known as the Johnson manoeuvre,²⁸ in nine cases. The principle behind this is that 'the uterus has to be lifted into the abdominal cavity above the level of the umbilicus before repositioning can occur. It is thought that the passive action of uterine ligaments will rectify the uterine inversion.'²⁸ The chances of immediate reduction are quoted as 43–88%.^{9,17,24} In Johnson's description the whole hand, plus two-thirds of the forearm, is placed in the vagina. Holding the fundus in the palm and keeping the tips of the fingers at the uterocervical junction, the fundus is raised above the level of the umbilicus. It may be necessary to apply digital pressure constantly, sometimes for several minutes. This places the uterine ligaments under tension. The tension generated relaxes and widens the cervical ring and facilitates the passage of the fundus through the ring. The inversion is, thus, corrected.²⁸ If repositioning takes place before oedema of the uterus and a contraction ring develops, the procedure is relatively easy to perform. As timing is crucial, if manual replacement fails, performing the hydrostatic method in an operating theatre should be considered. Once uterine replacement is successful, the uterus should be held in place for a few minutes and uterotonics administered to promote contraction of the uterus and to prevent re-inversion.^{29,30} Appropriate antibiotic cover is required to prevent infection.²³ The placenta should only be removed after repositioning of the uterus and complete correction of the inversion in order to avoid shock and torrential bleeding.³¹

The main problem surrounding the Johnson manoeuvre is that, because of the rarity of acute

Degree	Description
First (incomplete)	The inverted fundus extends to, but not beyond, the cervical ring
Second (incomplete)	The inverted fundus extends through the cervical ring but remains within the vagina
Third (complete)	The inverted fundus extends down to the introitus
Fourth (total)	The vagina is also inverted

Box 1
Categories of acute uterine inversion by severity^{16,18–23}

uterine inversion, it is difficult for birth attendants to acquire proficiency in this procedure. Therefore, there is a role for simulation training.

Hydrostatic methods

In 1945 JV O'Sullivan published the first report of two cases describing hydrostatic replacement of the uterus following acute uterine inversion.³² Although authors have reported successful repositioning in individual case reports, a literature search failed to yield the success rate of the O'Sullivan technique. The World Health Organization³³ recommends that if manual replacement fails, hydrostatic methods should be used.

Before attempting this method, uterine rupture must be excluded.²³ The procedure is performed in an operating theatre with the woman in the lithotomy position. Warm sterile water or isotonic sodium chloride solution is rapidly instilled into the vagina via a rubber tube or intravenous giving set, while the accoucheur's hand blocks the introitus. The fluid distends the vagina and pushes the fundus upwards into its natural position by hydrostatic pressure. The bag of fluid should be elevated approximately 100–150 cm above the level of the vagina to ensure sufficient pressure for insufflation. The problem with this method is the difficulty in maintaining a tight seal at the introitus.³² This can be overcome by the use of a silastic ventouse cup (Figure 3), although a hand may still be necessary to ensure a tight seal.³⁴

The literature gives little guidance regarding how to use the silicone cup. It is important not to seal the cup over the inverted fundus: instead, the cup should be positioned in the direction of the posterior fornix to allow vaginal distension. Advocates of the

Signs
Lump in the vagina
Abdominal tenderness
Absence of uterine fundus on abdominal palpation
Polypoidal red mass in the vagina with placenta attached
Symptoms
Severe abdominal pain
Sudden cardiovascular collapse
Postpartum haemorrhage

Box 2
Signs and symptoms of acute uterine inversion

Box 3
Differential diagnosis of uterine inversion

- Uterovaginal prolapse
- Fibroid polyp
- Postpartum collapse
- Severe uterine atony
- Neurogenic collapse
- Coagulopathy
- Retained placenta without inversion

ventouse approach believe that a better seal is achieved but it may prove time consuming to obtain a fluid-giving set of appropriate bore to attach to the cup inflow. There is no evidence of any particular method being significantly more likely to correct inversion or prevent haemorrhage.

The possible complications associated with hydrostatic methods are: infection, failure of the procedure and, theoretically, saline embolus.^{1,23} Although as much as 5 litres has been recommended as the infusion volume, there have been no reported cases of saline embolus or pulmonary oedema.³⁵

Is there a role for tocolysis?

In the presence of a constriction ring, reduction of uterine inversion can be very difficult. Tocolysis has a role in relaxing the uterus before manual

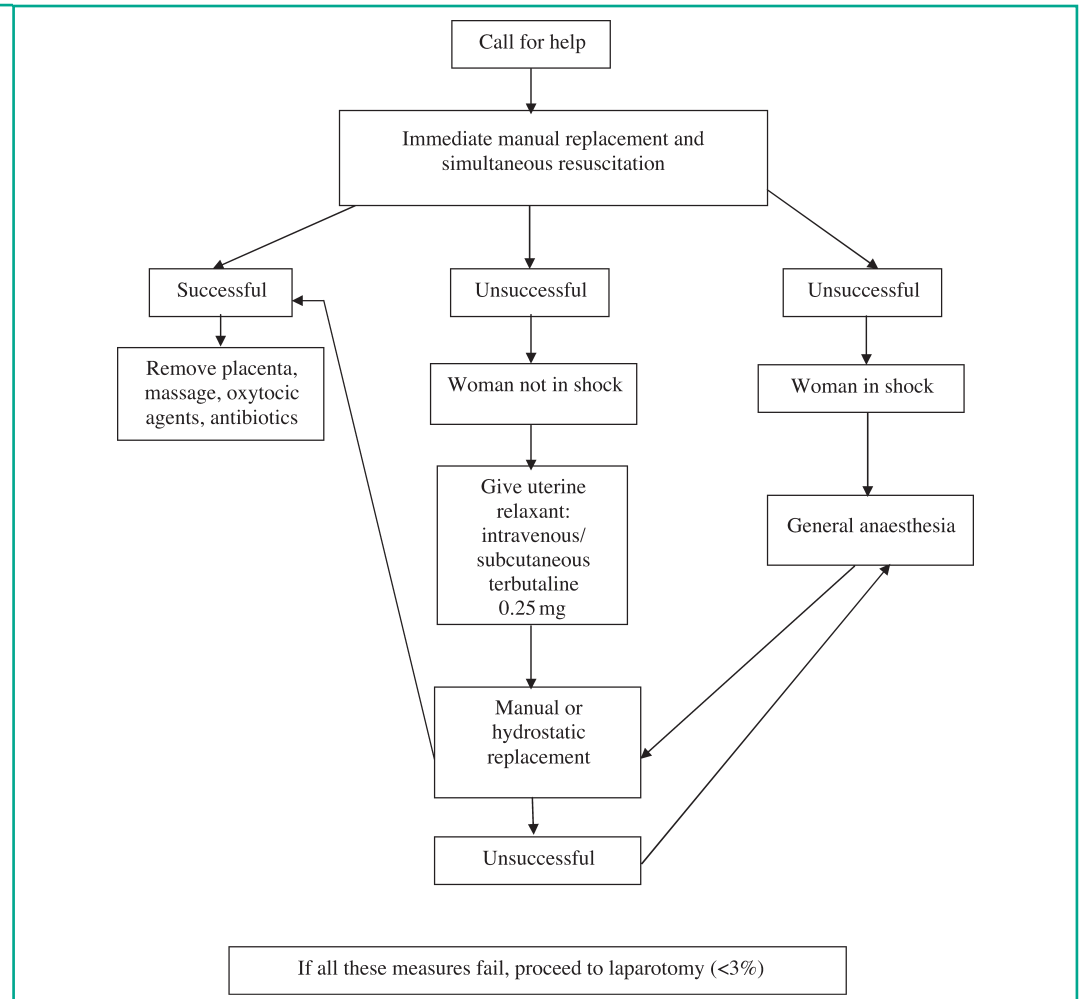
replacement or use of the hydrostatic method. The adverse effect of tocolytic-mediated reduction in uterine tone, however, is an aggravation of postpartum haemorrhage, which is especially undesirable in the presence of shock.^{26,27} Given that the rate of postpartum haemorrhage is quoted at 94%,²⁶ in the presence of acute inversion, the role of tocolysis is very controversial. Many drugs have been used to achieve tocolysis in acute inversion. These include: magnesium sulphate (4–6 g intravenously [IV] over 20 minutes),²⁶ nitroglycerin (100 micrograms IV slowly, achieving uterine relaxation in 90 seconds when given sublingually) and terbutaline (0.25 mg IV slowly).^{26,36,37} Terbutaline and magnesium sulphate take 2 and 10 minutes, respectively, to be effective.²⁸ Abouleish *et al.*⁹ recommended terbutaline as first-line treatment because of its rapid onset of action, short half-life, ease of use, availability on the labour ward and familiarity to the obstetrician.

In practice, rather than pursuing the use of tocolysis on a conscious woman, it will be necessary to transfer the women to an operating theatre for general anaesthesia relatively early.

The role of general anaesthesia

If manual replacement fails, general anaesthesia is required. The advantage of general anaesthesia is

Figure 2
Algorithm of management of acute uterine inversion



that, in addition to maternal pain relief, it promotes uterine relaxation.¹⁹ In the past, the use of halothane inhalation was advocated because of its uterine relaxation properties.^{37,38} With the availability of safer anaesthetic agents and the risk of severe hypotension with halothane, however, it is no longer preferred.

Surgical management

The above methods are expected to work in most cases. The need for surgery is rare. For completeness, some of the techniques used are outlined below. We believe that there is no role for vaginal surgery.

Abdominal

Huntingdon's operation

The abdomen is opened and the inversion site is exposed. A crater will be noted in the region of the cervix, with indrawn tubes and round ligaments. Two Allis forceps are introduced into the crater on each side and gentle upward traction is exerted on the forceps, with a further placement of forceps on the advancing fundus. By doing this, the uterus is pulled out of the constriction ring and restored to its normal position.³⁹

Haultain's operation

In this operation the cervical ring is incised posteriorly with a longitudinal incision. The rest of the steps are similar to Huntingdon's method. Once the uterus has been repositioned all incisions in the cervix, uterus and vagina are closed with interrupted sutures. Uterotonics are given to maintain contraction of the uterus.⁴⁰

Recent techniques described in the literature

Vijayaraghvan *et al.*²⁶ reported a case where acute inversion of the uterus was managed under laparoscopic guidance, citing the advantages of laparoscopic surgery as the reason for the procedure. Consideration, however, needs to be given to the woman's haemodynamic status and the possible effects of pneumoperitoneum.

Antonelli *et al.*⁴¹ reported a case where laparotomy was performed and a silastic cup used from above for the correction of complete acute inversion of the uterus. The stated advantages of using a silastic cup were that it was gentler on the tissues and afforded easy placement and manoeuvring through the constriction ring.

Future considerations

It is important to debrief women carefully about the events surrounding acute uterine inversion. At the same time, one should also inform them that it may recur and, therefore, there is a need for hospital delivery and active management of the

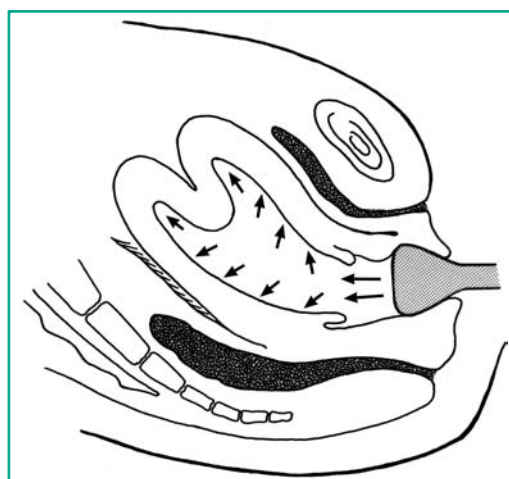


Figure 3
Hydrostatic method of reduction with a silastic ventouse cup. (Drawn by and reproduced with the kind permission of Bryony Cohen, Medical Illustration Department, St Bartholomew's Hospital, London, UK)

third stage of labour. They should also be reassured that fertility and reproductive outcome are not compromised following surgical correction.^{5,42}

Conclusion

The management of acute uterine inversion should be incorporated into skills and drills training. As it is a rare condition, the precise incidence is unknown. In order to record every case in the UK, we recommend establishing a register.

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