

9

OBSTETRIC TRAUMA

D. G. Evans and C. B-Lynch

ACUTE UTERINE INVERSION

Acute uterine inversion, defined as when the uterus is turned inside out, is a rare but serious complication of the third stage of labor. The estimated incidence is approximately 1 in 20–25 000 deliveries^{1–3}. As the estimate of a later report was < 1 : 2000⁴, the true incidence is unclear because some of the milder forms correct themselves spontaneously and are thus not recognized or reported.

Classification

Uterine inversion may be complete or incomplete, depending on whether the fundus has passed through the cervix⁵. When the uterine inversion occurs within the first 24 h post-delivery, it is classified as acute. Inversion occurring after the first 24 h and up to 4 weeks postpartum is classified as sub-acute, and the rare chronic inversion occurs after the 4th week postpartum.

Etiology

The expulsion of the placenta was probably intended by Nature to occur as a result of gravitational forces, with the mother in the same squatting position that is often adopted for defecation. When the third stage is conducted in the dorsal position, however, help may be necessary for placental expulsion. Accordingly, the inappropriate management of the third stage of labor is often implicated in the etiology of acute uterine inversion. Indeed, Crede's method of placental delivery with uncontrolled cord traction, referred to in most textbooks of midwifery and older textbooks of obstetrics, may indeed increase the risk of acute uterine inversion. The

firmly contracted uterus is used as a piston to push the placenta out, in the same manner that a piston is used to push fluid out of the barrel of a syringe. Pressure is applied with the palm of the hand in the axis of the pelvic inlet, in a downward and backward direction with the aim of forcing the placenta out through the lower genital tract. Unfortunately, application of Crede's maneuver when the uterus is not contracted may well facilitate acute inversion. On the other hand, the Brandt Andrews maneuver, also mentioned in standard textbooks of midwifery and obstetrics, a modification of Aristotle's method of delivering the placenta by cord traction, recommends applying tension, but not traction, to the umbilical cord with one hand, whilst the other hand is placed on the abdomen gently moving the uterus upwards and backwards. Today, controlled cord traction is standard practice for the third stage of labor.

Other etiological factors include forcibly attempting to expel the placenta by using fundal pressure when the uterus is atonic, and traction on the umbilical cord in a fundally placed placenta when the uterus is relaxed. It may also be brought about by a local atony, more particularly of the fundal placental site together with active contractions of the rest of the uterus. Other etiological factors include macrosomia, polyhydramnios, multiple pregnancy, primiparity and oxytocin administration⁵. In other instances, however, the inversion occurs spontaneously from sudden increased abdominal pressure as a result of coughing, sneezing or straining.

Chronic inversion may result from an acute inversion left unrecognized or from a sub-mucous fibroid which has prolapsed through the cervix. A placental polyp resulting from a retained cotyledon of the placenta may present in the same fashion.

Diagnosis

Symptoms are acute and pronounced. Generally, the mother is aware of something coming down and this is usually quickly followed by unanticipated profound shock. The uterus may appear at the introitus outside the vagina and the fundus is no longer palpable abdominally. In partial inversion, the fundus of the uterus may be indented and may or may not pass through the cervical os. In such instances, it is neither palpable abdominally nor visible at the vulva. Vaginal examination detects the inverted body of the uterus, and, above and encircling it, the ring of the cervix. In all instances, pain may be severe due to stretching of the infundibulopelvic ligaments and other viscera.

Shock is the outstanding sign, and may in part be neurogenic due to stretching of the viscera and in part due to hemorrhage and hypovolemia. The degree of shock is proportional to blood loss and hemorrhage is variable, depending on whether any attempt has been made to remove the placenta. Some bleeding will always be present unless the placenta is completely adherent to the uterine wall. It is important to recognize that severe hemorrhage will accompany any attempt at removing the placenta before the uterus is replaced^{5,6}. This eventuality is a special risk if the birth has been attended by a traditional birth attendant (TBA) in parts of the underdeveloped world.

Management

Acute uterine inversion is a true obstetric emergency⁶, and clearly one which may lead to severe postpartum hemorrhage. If present and available, a supportive team should be summoned to the delivery suite for resuscitation and protocol management (see Chapter 20). Uterotomies, if started, are to be stopped and manual replacement attempted under adequate and appropriate anesthesia followed by delivery of the placenta assisted by restart of oxytocin⁷.

Elevation of the foot of the delivery table or bed may relieve the tension on the viscera and reduce the pain and shock. Immediate resuscitation with intravenous fluids is indicated via large-gauge venous access. Adequate analgesia

must be instituted prior to attempting replacement, and the bladder should be catheterized. Antibiotic prophylaxis is advisable.

Any delay increases the difficulty in replacing the uterus, and the first health-care professional present should make the initial attempt at replacement. This will be aided if regional anesthetic is already in place⁸. The placenta should be left *in situ* and no attempt made to remove it. The portion of the uterus that came down last should go back first, that is, the lower segment initially and the fundus later. The hand is lubricated with hibitane cream (or other suitable antiseptic if available) and placed inside the vagina. With gentle maneuvers of the fingers around the cervical rim and simultaneous upward pressure with the palm of the hand, the uterus is gradually replaced. The employment of force is dangerous, as the thinned-out lower segment may be torn or otherwise traumatized. The vaginal vault may already have been torn in some cases. The degree of shock does not diminish until the uterus is replaced. In the majority of instances, replacement of the uterus is successful using this conservative method⁹. If replacement is successful, the placenta should be manually removed with the aid of ergometrine or an oxytocic infusion. In underdeveloped countries or in a home setting, boiled water brought to a bearable temperature can be used to soak clean towels or cloths to assist in pushing and packing the vagina. This may facilitate replacement attempts and control further blood loss. Bimanual massage of the fundus may improve contraction.

If replacement is unsuccessful, measures to relax the cervical retraction ring should be the next line of therapy. Beta mimetics or amyl nitrite inhalation can often relax the retraction ring sufficiently to allow uterine replacement⁹. A similar effect is seen with the administration of halothane anesthesia, but, unfortunately, use of this agent in sufficient doses can result in the unwanted and life-threatening complications of uterine atony, hypotension and severe hemorrhage. Halothane is no longer used for these and other reasons. A 2 g intravenous bolus of magnesium sulfate can be used in the hypotensive patient (0.25 mg of intravenous terbutaline in the stable patient) to relax the cervical contraction ring¹⁰. Intravenous

POSTPARTUM HEMORRHAGE

nitroglycerine can be tried although it is not commonly used.

Further attempts at replacement of the uterus should take place under general anesthesia in an operating theater equipped and ready to perform a laparotomy. Before resorting to a laparotomy, however, the tried and tested O'Sullivan hydrostatic technique¹¹ should be attempted. Here, the patient is first resuscitated to restore vital signs including adequate blood volume and pressure. The obstetric team and anesthetist are summoned.

Adequate analgesia is essential before:

- (1) Attempt at repositioning without the use of uterine relaxant;
- (2) If response is not imminent or sustained, an anesthetist should provide uterine relaxation to facilitate repositioning and the administration of uterotonics;
- (3) General anesthesia is preferable, administered by an obstetric anesthetist. Digital repositioning should be maintained to support and establish good uterine muscle tone;
- (4) 1–2 liters of saline at body temperature should be infused into the vagina through rubber tubes placed in the posterior fornix, whilst obliterating the introitus with the obstetrician's hand. As the vaginal walls distend, the fundus of the uterus rises and the inversion is usually promptly corrected. Once this is achieved, fluid is allowed to slowly escape from the vagina whilst the placement of the uterine fundus is achieved and maintained.

When O'Sullivan first described this technique, he used a douche-can and wide rubber tubing to deliver the solution. More recently, a silastic vacuum cup has been used to instil the sterile solution into the vagina¹². Until replacement is effected, however, towels soaked in warm hypertonic saline solution and draped over the inverted uterus may reduce the edema which will inevitably occur and which further impedes replacement of the uterus. In extremely difficult cases, replacement may require mid-line laparotomy, with the patient cleansed and draped in the Lloyd Davis (frog-legged) position with a

head-down (Trendelenberg) tilt. The patient is catheterized with an indwelling catheter and broad-spectrum antibiotics are administered. With the bowels packed upward and away from the uterus, the obstetric surgeon places his hands in front and back of the lower segment with the finger tips between and below the level of the inverted fundus. With progressive pressure on the fingertips of both hands which flip up simultaneously, the internal dimple is replaced progressively by the rising uterine fundus (Figure 1a–e)¹³. Uterine perfusion returns with re-establishment of uterine pulse pressure.

If this technique fails, then the mid-line abdominal incision can be extended upwards if necessary. The inverted uterus resembles a funnel; it is best to exteriorize the uterus. Instrumental upward traction is applied to the round ligaments bilaterally using Allis or ring forceps, while the assistant exerts upward pressure on the inverted parts from the vagina below. This maneuver is the Huntington technique^{14,15}.

Failure at this stage warrants employing the Haultain technique whereby an incision is made vertically in the posterior cervix via the abdominal route, following the dimple as a guide to relieve the constriction at this level. The assistant exerts upward pressure from the vagina to effect reduction and replacement¹⁶.

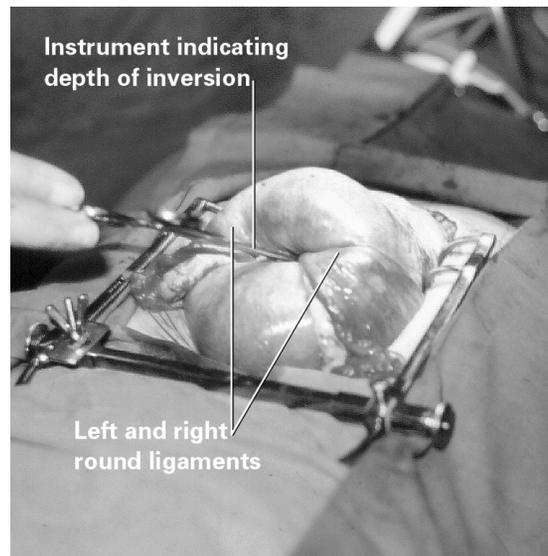


Figure 1a Acute uterine inversion

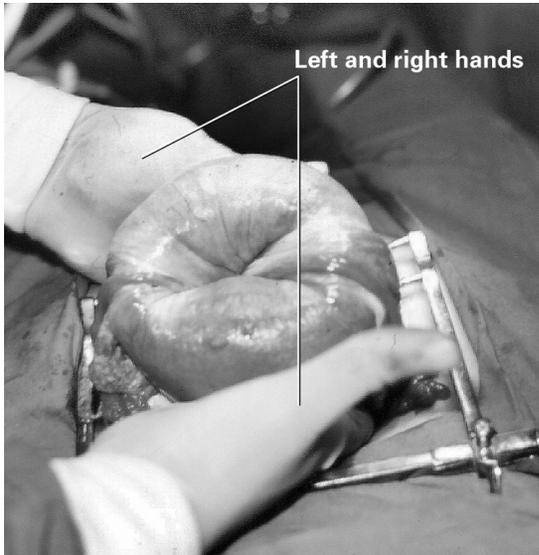


Figure 1b Acute uterine inversion. Finger tips placed below fundus of uterus to facilitate reduction



Figure 1d Acute uterine inversion. Return of vascularity



Figure 1c Acute uterine inversion. Progressive reduction with some ischemia

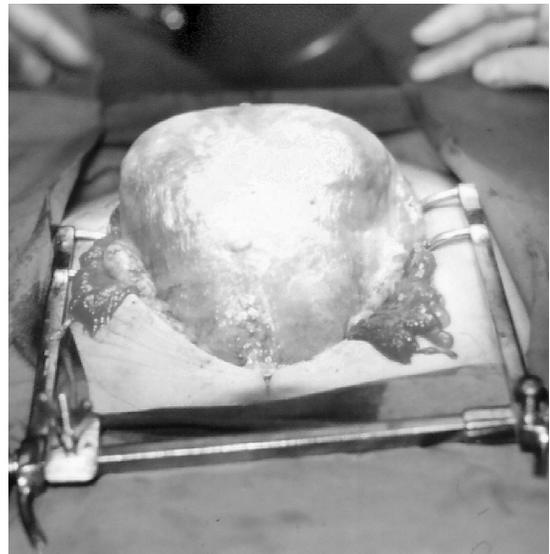


Figure 1e Acute uterine inversion. Complete reduction and revascularization with normal clinical features. (B-Lynch technique of non-instrumental reduction of acute uterine inversion at laparotomy. ©Copyright '05)

On return of the uterus to its normal position, the placenta should be removed manually from the vagina, and uterine contraction maintained abdominally by bi-manual stimulation. Ergometrine, oxytocic intravenous infusion, or mesoprostyl can be administered. The posterior uterine incision, if used, is then repaired in layers, and the abdomen closed in the usual fashion. The patient should be monitored in the

intensive care or the high-dependency unit for 24 h.

A sub-acute inversion is managed in a similar manner but may resolve spontaneously as the uterus involutes⁴.

In chronic inversion, the uterus involutes in its inverted position and remains in the vagina as a soft swelling, which bleeds readily to touch and shows areas of superficial ulceration. Prolonged inversion may result in conversion of the columnar epithelium of the uterine wall into a stratified squamous epithelium. Replacement of a chronic inversion can prove extremely difficult, due partly to the inevitable edema present and the friable nature of the tissues. The techniques adopted for replacing the acutely inverted uterus are no longer helpful in this chronic situation. Bed rest, elevation of the foot of the bed, antibiotic prophylaxis, and vaginal cleansing with hibitane packs may be helpful to reduce the edema and treat any infections, but it may eventually be necessary to perform a hysterectomy. If the chronic inversion is due to the presence of a fibroid or a placental polyp, initial removal of the polyp by ligating and cutting the pedicle as near to the base as possible may facilitate replacement of the inverted uterus.

RUPTURED UTERUS

Uterine rupture is a serious obstetric complication with high morbidity and mortality. In developed countries, the increasing number of Cesarean sections performed for minor degrees of disproportion, fetal distress or pre-eclampsia in primiparae is of considerable importance in calculating the long-term risks associated with Cesarean section, particularly in terms of the incidence and risk of uterine rupture. Both the short- and long-term risks are accentuated in resource-poor countries.

Uterine rupture may be complete when the tear extends into the peritoneal cavity, or incomplete when the serosa remains intact. The rupture may be spontaneous, traumatic or the result of scar dehiscence and may occur either during pregnancy, early in labor or following a prolonged labor¹⁷.

In developed countries, the most common cause of uterine rupture is dehiscence of a previous lower segment transverse Cesarean section scar. Rupture of a classical scar is eight times more common than that of a previous lower segment incision, and is far more apt to occur before rather than during labor. Previous

rupture of a scar confers a 10–20-fold increase in risk of a subsequent rupture^{18,19}.

Rupture of the uterus is generally sudden, accompanied by severe abdominal pain and followed by vascular collapse. In many cases, however, asymptomatic dehiscence takes place during a vaginal delivery after a previous Cesarean section, when the dehiscence is gradual and retraction of the uterus arrests hemorrhage from the wound. Because of this possibility, it is always necessary to exclude silent dehiscence by manual exploration of the uterus after delivery of the fetus when a scar is present on the uterus.

A major factor in spontaneous uterine rupture is obstructed labor, especially in the developing world when women routinely deliver without the benefit of the presence of trained health-care providers. Rupture may be due to maternal or fetal causes (generally macrosomia). Examples of maternal causes are cephalopelvic disproportion from pelvic contraction due to developmental, constitutional or nutritional causes, abnormal presentation such as shoulder presentation, breech or brow, persistent mentoposterior face presentation, transverse lie, fetal abnormality, hydrocephalus, fetal tumor, fetal ascites, conjoined twins, maternal tumors, intrinsic cervical lesions, extrinsic fibroids or tumor, locked twins, and rarely uterine misalignment such as incarcerated retroverted uterus, and pathological uterine anteversion. Additionally, grand multiparity, the use of uterotonic drugs to induce or augment labor, placenta percreta, and intrauterine manipulation have all been implicated as causes of uterine rupture^{19,20}.

The most common predisposing cause of rupture during pregnancy is a weak scar following a previous Cesarean section²⁰. Rarely, rupture can occur following unrecognized injury to the uterus at a previous difficult delivery. It may present with sudden severe abdominal pains and collapse, or the symptoms may present gradually, when rupture is based on scar dehiscence. If the onset is gradual, diagnosis may be difficult as the abdominal pain may be slight and accompanied only by alterations in the fetal heart tracing, maternal tachycardia and minimal vaginal bleeding. This triad is then followed by patient collapse, cessation of fetal

movement and easy palpation of the fetal parts if the fetus has been expelled completely into the peritoneal cavity. If the patient is in a hospital and the catastrophe recognized at its onset, the outcome should be the safe delivery of the baby and repair of the uterus. If the patient is not in a hospital, on the other hand, the catastrophe is just that, a catastrophe of a dead child and its mother.

Uterine rupture during labor is also most commonly due to dehiscence of a previous Cesarean scar with pain over the scar, followed by sudden severe abdominal pain and collapse. In grand multiparae with a friable inelastic uterine wall, rupture may occur in early labor even where there has been no previous scar or difficult delivery, although this eventuality is not nearly as common as rupture in the previously scarred uterus. Here, however, diagnosis may be difficult initially as the presentation may be confused with a small accidental hemorrhage and therefore missed.

Rupture after a prolonged labor is commonly due to obstructed labor, with marked thinning of the lower segment and increased retraction of the upper segment resulting in the formation of a retraction or Bandl's ring. The tear begins in the lower uterine segment, may extend up to the fundus or down into the vagina, or proceed laterally into the broad ligament. If the tear is posterior, it may go through the posterior vaginal fornix into the Pouch of Douglas (colporrhexis)²⁰. If the rupture is in the lower anterior segment, the bladder is stripped from its attachment to the lower segment. The peritoneum remains intact and so the rupture is characterized as incomplete. A multiparous patient in obstructed labor will continue to have tetanic contractions until the uterus ruptures, whilst a primiparous patient will usually go out of labor. Classical clinical signs of a rupture in a multiparous patient can be dramatic; abdominal pain is constant, the contractions become virtually continuous initially with only short intervals between them and later no interval between contractile forces, with the formation of a Bandl's ring followed by rupture and collapse. The contractions then usually stop²⁰⁻²², the fetus is expelled into the peritoneal cavity, the fetal parts are easily palpable and the uterus adopts an altered shape.

Rarely, the uterus may rupture during early to mid-pregnancy or during labor in patients who have had a previous cornual ectopic pregnancy. Here also, the rupture is dramatic, is located over the repair site of the ectopic and is characterized as a fundal blow-out. Sudden severe abdominal pain is experienced over the fundus of the uterus followed by collapse.

Rupture of a previously unscarred uterus is usually a catastrophic event resulting in death of the infant, extensive damage to the uterus and a very high risk of maternal death from blood loss. The damage to the uterus may be so extensive that repair is impossible and a hysterectomy is required. In developed countries, the incidence of ruptured uterus in an unscarred uterus is approximately 1 : 10 000 deliveries²²; in the underdeveloped countries, the data are unknown. The incidence of rupture of a uterus with a previous Cesarean section scar is 1%^{22,23}. A trial of labor following a previous Cesarean section increases the risk of perinatal death and rupture of the uterus compared to elective repeat Cesarean section. In one large Canadian study, a trial of labor following a previous Cesarean section was associated with an increased risk of rupture (by 0.56%) but fewer maternal deaths than in an elective section (1.6 vs. 5.6 per 100 000)¹⁹.

In less developed countries, the incidence of uterine rupture varies from 1.4% to 25%, with 25% in Ethiopian women with obstructed labor²³. Uterine rupture accounted for 9.3% of maternal mortality in one study from India and 6.2% in a study from South Africa²⁴.

A laparotomy is indicated when rupture of the uterus is suspected. The patient is anesthetized, cleansed, draped and the bladder catheterized with an indwelling catheter. A mid-line lower abdominal incision should be used as this may be extended cephalad if necessary. The fetus should be delivered expeditiously and the uterus delivered from the abdominal incision to assist in controlling the bleeding and assessing the situation while resuscitative measures are undertaken. In the series of over 1300 worldwide reported successful applications of the B-Lynch (Brace) suture, 25 cases were applied for persistent uterine atony after repair of a uterine rupture. In these cases, successful bleeding control and hemostasis were achieved (CBL

world-wide communication www.CBLynch.com)²⁵.

Hysterectomy may be necessary and should have been consented, if at all possible. It is not necessary to remove the ovaries merely because this is easier in a crisis. As with a Cesarean hysterectomy performed in late labor, the cervix is no longer a discrete and circumscribed solid structure, easily delineated and permitting accurate placement of vaginal clamps. In the acute situation, hemostasis and avoidance of further dissection are of paramount importance, and the removal of the distal cervix is not critical. The most difficult surgical situation occurs when the rupture is extraperitoneal into the broad ligament, with a massive hematoma distorting the anatomy and obscuring the bleeding points. Here, it may be necessary to pack the space, the end of the pack being brought out through a gap in the uterine repair²⁰. A balloon catheter with light traction may be used for enhanced tamponade with or without the application of the B-Lynch (Brace) suture application²⁶.

Other conservative surgery may be appropriate on occasions, for example, when simple repair of the tear may be preferable to hysterectomy. With an anterior rupture, the bladder may be involved; the appearance of hematuria is almost pathognomonic. Repair is undertaken and the bladder catheterized for 2 weeks. A posterior fornix rupture (colporrhexis) is relatively easy to repair. Incomplete rupture is not usually apparent until delivery has been achieved. It will commonly declare itself by intrapartum or postpartum hemorrhage. It should always be excluded by manual exploration after delivery of the fetus. Both bladder tears and colporrhexis may be missed if not anticipated. If this is the case, bleeding may continue, to the surgeon's dismay.

BLUNT ABDOMINAL TRAUMA

The three main causes of serious blunt abdominal trauma in pregnancy are motor vehicle accidents, falls and domestic or intimate partner physical abuse. In the developed world, the most common cause of blunt abdominal trauma is motor vehicle accidents^{27,28}. In the less developed countries, the incidence of

domestic physical abuse or intimate partner physical abuse can be as high as 13.5%²⁹. Developed countries are not immune from this problem, however, and a large review of the prevalence of abuse during pregnancy in the United States documented that between 0.9% and 20.1% of pregnant women were abused by their partners. This figure covers all forms of abuse, emotional, physical and sexual³⁰.

Direct abdominal trauma by punching or kicking the abdomen increases the risk of adverse outcome of the pregnancy. Adverse outcomes are more common with direct physical assaults than with motor vehicle accidents^{29,30}. Partner abuse also tends to be a repetitive event, increasing the risk to the fetus³¹. In some countries, partner abuse and violence against women is accepted as a cultural norm, thus reducing the numbers of reported cases. Even in the Chinese community in Hong Kong and despite western socialization, it is not uncommon for women to submit to their husbands and endure humiliation for the sake of keeping their family together. Providing help for these pregnant women is challenging³².

Motor vehicle accidents account for 60–75% of cases of blunt trauma. Most injuries are minor, but, in the United States, between 1300 and 3900 women each year suffer a fetal loss as a result of a motor vehicle accident^{27,28}. Despite the majority of the injuries being minor, the fetus is always at risk and careful assessment must be carried out in all cases of blunt abdominal trauma resulting from motor vehicle accidents. Assessments must be frequent and repeated with special attention to conditions commonly seen after such trauma. These include abruptio placentae, preterm labor, uterine rupture, fetomaternal hemorrhage, direct fetal injury and fetal demise³³.

The pattern of injury following automobile accidents depends on the type of seat belt restraints. An unbelted driver or passenger is usually ejected from the vehicle or sustains injuries when they hit the interior of the car. The injuries are mainly to the face, head, chest, abdomen and pelvis. With shoulder and abdominal restraints, rib, sternum and clavicular fractures are common, whereas in the lap-only belted, lumbar spine and hollow viscus injuries are more frequent. Sharp objects in the

pockets of the clothing on the person can cause additional trauma; a fountain pen may perforate the lungs or heart. Even bulky outdoor over-clothing represents a hazard. With thick clothing, there is a short distance between the body of the person and the restraint. On impact, the weight of the body causes acceleration forwards. The speed of contact between the person and the restraint can compound the damage sustained to the body.

During the first trimester, the uterus is well protected within the pelvis and sustains very little damage from blunt trauma. With advancing pregnancy, however, the uterus becomes an abdominal organ and therefore more susceptible to trauma. The blood supply to the pelvis is markedly increased the more advanced the pregnancy, giving rise to retroperitoneal hemorrhage which can be life-threatening. Bowel injuries are less common, as the bowel occupies the upper abdominal space later in pregnancy, is a more movable entity and is not in the direct line of the trauma.

Assessing the extent of trauma can be difficult, as clinical signs initially may be sparse. Patients should be assessed frequently to detect deterioration in their condition. The presence of bony injuries should raise suspicion of intra-peritoneal hemorrhage: rib fractures are associated with liver and spleen injuries and pelvic fractures with retroperitoneal hemorrhage and injury to the genitourinary system.

Difficulty is often encountered in detecting a small amount of bleeding into the peritoneal cavity. As blood may be non-irritant, ultrasound examination may be equivocal, and CT scanning exposes the fetus to a large radioactive dose. The decision to proceed to a laparotomy may therefore be entirely based on clinical judgement.

The most common cause of fetal death in non-fatal accidents is abruptio placentae. In minor injuries, the incidence is between 1 and 5%, in contrast to major trauma where the incidence may be as high as 30%. At the time of impact, the intrauterine pressure may be as high as ten times the pressure reached at the height of a labor contraction. Blunt trauma causes the uterus to compress and then expand and the placenta shears away from the uterine wall. The degree of separation may bear no

relationship to the degree of trauma; abruption may occur with very little evidence of injury to the mother. It usually, but not always, follows soon after the trauma.

Vaginal bleeding, abdominal pain, increased uterine tone, uterine tenderness, high frequency contractions, and abnormal fetal cardiotocography are the classical clinical signs of a placental abruption. In a posteriorly inserted placenta, severe backache and vaginal bleeding may be significant symptoms. The bleeding may be revealed or concealed within the uterus. If concealed, in severe cases, the uterus becomes woody hard as described by Couvelaire, blood having been extravasated into the muscular wall of the uterus. Fetal parts are impossible to feel and the patient's condition rapidly deteriorates due to hypovolemia and pain.

The management of abruptio placentae depends on the severity of the abruption, the nature of the general injuries sustained, the condition of the fetus and the duration of the pregnancy. The trauma surgeon and the obstetrician should work together in managing the patient. Establishing wide-bore intravenous access is essential. The hematologist should also be involved. A complete thrombophilia screen should be requested and cross-matched blood organized, together with fresh frozen plasma.

A preterm uncompromised fetus should be observed by continuous cardiotocography for a minimum of 6–12 h or by a Pinard stethoscope in less developed communities and, if the gestation is under 34 weeks, the mother should be given corticosteroids to minimize the adverse effect of prematurity on lung maturation. If the fetus is pre-viable and compromised, vaginal delivery is the safest for the mother.

In a term pregnancy with abruptio and an uncompromised fetus, vaginal delivery is an option. However, Cesarean section is advised if the fetus is compromised. If the fetus, on the other hand, has died, induction of labor and vaginal delivery are appropriate and safe for the mother.

Preterm labor following blunt abdominal trauma may be precipitated by extravasation of blood into the myometrium stimulating uterine contraction. Prostaglandin release may stimulate uterine activity. Preterm labor requiring tocolysis occurs in 10–30% of cases of blunt

abdominal trauma, but less than 1% deliver before 34 weeks. Tocolytics should be used guardedly, lest they mask the sign of abruption. Contractions following blunt abdominal trauma abate without treatment in 90% of cases. All tocolytics have side-effects which the obstetrician should be familiar with: beta mimetics induce tachycardia and may mask the early signs of abruption; non-steroidal anti-inflammatory agents affect platelet and renal function; and calcium channel blockers cause hypertension. The fetal heart rate and the uterine contractions should be continuously monitored³⁴.

Uterine rupture is a rare (1%) occurrence in blunt abdominal trauma; when it does occur, it is usually in association with a fractured pelvis. The site of rupture is commonly the fundus of the uterus or the site of a previous uterine scar. Fetal mortality in such cases is 100%, and maternal mortality 10%³⁵⁻³⁸. Diagnosis may be difficult with vague abdominal pain, uterine tenderness, but with easily palpable fetal parts, and a poor trace or absence of a fetal heart on cardiotocography. Fetal demise and maternal shock are more dramatic presentations.

If suspected, exploratory laparotomy in the presence of the trauma surgeon is indicated. Uterine repair should be undertaken only if the patient is hemodynamically stable. If not, hysterectomy should be performed. However, the risk of a rupture in a subsequent pregnancy is high, and the patient and her family should be advised this at an appropriate time.

Fetal injury occurs very infrequently following blunt abdominal trauma. Fracture of the long bones or the skull is the most common injury and occurs in approximately 1% of cases. If the fetus is distressed, immediate delivery is called for. In the preterm non-compromised fetus, delivery may be delayed, but serial monitoring is advised^{39,40}.

Fetomaternal hemorrhage occurs in up to 30% of cases of blunt abdominal trauma, especially if the placenta is situated anteriorly. Most fetuses will have a normal outcome, although anemia, supraventricular tachycardia and fetal demise can occur depending on the extent of the fetomaternal hemorrhage^{41,42}. Victims of blunt abdominal trauma should be screened for Rhesus factor, and all Rhesus-negative mothers

given Anti-D immunoglobulin to prevent sensitization. Sensitization can occur as early as the 5th week of pregnancy. A Kleihauer-Betke test is essential to assess the magnitude of the fetomaternal hemorrhage and adjust the dose of Anti-D immunoglobulin accordingly.

In all cases of blunt abdominal injuries, fetal assessment is of paramount importance. Cardiotocography is the most sensitive method of immediate fetal surveillance. Ultrasonography is only accurate in predicting 40% of cases of abruption. Uterine activity is the most sensitive indicator for predicting abruption following blunt abdominal trauma. Frequent contractions have an adverse effect on fetal outcome.

As a guideline, patients who have sustained blunt abdominal trauma, but have no abdominal tenderness, no vaginal bleeding and no contractions should be monitored 2-hourly for 6-12 hours. Patients with abdominal tenderness, vaginal bleeding and contractions should be monitored continuously^{43,44}.

References

1. Spain AW. Acute inversion of the uterus. *J Obstet Gynaecol Br Empire* 1946;53:219
2. Das P. Inversion of the uterus. *J Obstet Gynaecol Br Empire* 1940;47:525-48
3. Fahmy M. Acute inversion of the uterus. *Int J Surg* 1977;62:100
4. Watson P, Besch N, Bowes WA. Management of acute and subacute puerperal inversion of the uterus. *Obstet Gynecol* 1980;55:12
5. Brar HS, Greenspoon JS, Platt LD, Paul RH. Acute puerperal uterine inversion. *J Reprod Med* 1989;34:173-7
6. Wendel PJ, Cox SM. Emergent obstetric management of uterine inversion. *Obstet Gynecol Clin N Am* 1995;22:261-74
7. Abouleish E, Ali V, Joumaa B, *et al.* Anaesthetic management of acute puerperal uterine inversion. *Br J Anaesth* 1995;75:486-7
8. Catanzarite VA, Moffitt KD, Baker ML, *et al.* New approach to the management of acute puerperal uterine inversion. *Obstet Gynecol* 1986; 68(Suppl):7-10
9. Clark SL. Use of ritodrine in uterine inversion. *Am J Obstet Gynecol* 1984;151:705
10. Grossman RA. Magnesium sulphate for uterine inversion. *J Reprod Med* 1981;26:261-2
11. O'Sullivan JV. Acute inversion of the uterus. *Br Med J* 1945;ii:282-3

12. Ogueh O, Ayida G. Acute uterine inversion: a new technique of hydrostatic replacement. *Br J Obstet Gynaecol* 1997;104:951-2
13. B-Lynch C. Non instrumental atraumatic stepwise reduction of acute uterine inversion. In press
14. Huntington JL. Acute inversion of the uterus. *Boston Med Surg J* 1921;184:376-80
15. Huntington JL, Irving PC, Kellogg PS. Abdominal reposition in acute inversion of the puerperal uterus. *Am J Obstet Gynecol* 1928;15:34-40
16. Haultain FWN. The treatment of chronic uterine inversion by abdominal hysterotomy with a successful case. *Br Med J* 1901;ii:974
17. Schrinsky DC, Benson RC. Rupture of the pregnant uterus: a review. *Obstet Gynaecol Surv* 1978;33:217-32
18. Ritchie EH. Pregnancy after rupture of the pregnant uterus. *J Obstet Gynaecol Br Commonwealth* 1971;78:642-8
19. Aguero O, Kizer S. Obstetric prognosis of the repair of uterine rupture. *Surg Gynaecol Obstet* 1968;127:528-30
20. Hudson CN. Obstructed labour and its sequelae. In Lawson JB, Harrison KA, Bergstrom S, eds. *Maternity Care in Developing Countries*. London: RCOG Press, 2001
21. Wen SW, Rusen ID, Walker M, et al. Comparison of maternal mortality and morbidity between trial of labor and elective Caesarean among women with previous caesarean delivery. *Am J Obstet Gynecol* 2004;19:1263-9
22. Miller DA, Goodwin TM, Cherman RB, Oaul RH. Intrapartum rupture of the unscarred uterus. *Obstet Gynecol* 1997;89:671-3
23. Gaym A. Obstructed labour in a district hospital. *Ethiop Med J* 2002;40:11
24. Rajaram P, Agarwal A, Swain S. Determinants of maternal mortality: a hospital based study from South India. *Ind J Matern Child Health* 1995;6:7-10
25. B-Lynch C. Persistent uterine atony after successful repair of ruptured uterus treated by Brace suture, world-wide reports and personal communication. www.cblynch.com
26. Danso D, Reginald P. Intrauterine balloon catheter with B-Lynch suture. *Br J Obstet Gynaecol* 2002;109:963
27. Esposito TJ, Gens DR, Smith IG, Scorpio R, Buchman T. Trauma during pregnancy. A review of 79 cases. *Arch Surg* 1991;126:1073-8
28. Hoff WS, D'Amelio LF, Tinkoff GH, et al. Maternal predictors of fetal demise in trauma during pregnancy. *Surg Gynecol Obstet* 1991;172:175-80
29. Valladares E, Pena R, Oeresson LA, Hogberg U. Violence against pregnant women: prevalence and characteristics. A population-based study in Nicaragua. *Br J Obstet Gynaecol* 2005;112:1234-48
30. Gazmararian JA, Lazorick S, Spitz AM, Ballard TJ, Saltzman LE, Marks JS. Prevalence of violence against women: a review of the literature. *JAMA* 1996;275:1915-20
31. Godwin TM, Breen MT. Pregnancy outcome and fetomaternal hemorrhage after non catastrophic trauma. *Am J Obstet Gynecol* 1990;162:665-71
32. Tiwari A, Leung WC, Leung TW, Humphreys J, Parker B, Ho PC. A randomised controlled trial of empowerment training for Chinese abused pregnant women in Hong Kong. *Br J Obstet Gynaecol* 2005;112:1249-56
33. Connolly A, Katz VL, Bash KL, McMahan MJ, Hansen WF. Trauma and pregnancy. *Am J Perinatol* 1997;14:331-6
34. Elliott M. Vehicular accidents and pregnancy. *Aust NZ J Obstet Gynaecol* 1966;6:279-86
35. Williams JK, McClain L, Rosemurgy AS, Colorado NM. Evaluation of blunt abdominal trauma in the third trimester of pregnancy: maternal, and fetal considerations. *Obstet Gynecol* 1990;75:33-7
36. American College of Obstetricians and Gynecologists. Trauma during pregnancy. ACOG Technical Bulletin No. 161, November 1991, Washington DC
37. Mighty H. Trauma in pregnancy. *Crit Care Clin* 1994;10:623-34
38. Dahmus MA, Sibai BN. Blunt abdominal trauma. Are there any predictive factors for abruptio placentae or maternal-fetal distress. *Am J Obstet Gynecol* 1993;169:1054-9
39. Lavin JP, PolSky SS. Abdominal trauma during pregnancy. *Clin Perinatol* 1983;10:423-38
40. Goodwin TM, Breen MT. Pregnancy outcome and fetomaternal hemorrhage after non-catastrophic trauma. *Am J Obstet Gynecol* 1990;162:665-71
41. Pearlman MD, Tintinalli JE, Lorenz RP. A prospective controlled study of outcome after trauma during pregnancy. *Am J Obstet Gynecol* 1990;162:1502-10
42. Rose PG, Strohm PL, Zuspan FP. Fetomaternal hemorrhage following trauma. *Am J Obstet Gynecol* 1985;153:844-7
43. Pearlman MD, Phillips ME. Safety belt use during pregnancy. *Obstet Gynecol* 1996;88:1026-9
44. Pearlman MD, Tintinalli JE, Lorenz RP. Blunt trauma during pregnancy. *N Engl J Med* 1991;323:1609-13