CASE REPORT

Definitive use of external fixation for pelvic ring injuries (open book/APC2) in pregnancy

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SUMMARY

Pelvic fractures in pregnancy are rare, resulting in a paucity of evidence-based management. We describe a case of open book pelvic injury in a 32-year-old woman in her third trimester of pregnancy. She was successfully managed with a supra-acetabular external fixator, which allowed the safe delivery of a healthy baby boy at 34 weeks, via caesarean section. The external fixator was removed postpartum, when the pelvis was deemed stable, and mother and baby both continue to do well. This is the only case in the literature that demonstrates the successful use of external fixation for pelvic injuries in pregnancy.

BACKGROUND

This case is important as it demonstrates the successful use of external fixation for initial temporary stabilisation and subsequent definitive management of a pelvic ring fracture in late pregnancy. It allows the fetus to remain in utero until mature enough for delivery, thereby offering the best outcomes for both mother and child.

The potential use of external fixation for this purpose is discussed in the literature, but only one other case was identified that describes actually using an external fixator (ex-fix) for this purpose.

Traumatic pelvic injuries during pregnancy are rare, and information in the literature on managing such complex injuries is limited. This case highlights a method of approaching this challenging injury with a successful outcome for both mother and child.

CASE PRESENTATION

A 29-year-old, 32+5 weeks pregnant woman was transferred to Addenbrookes Major Trauma Centre, Cambridge Hospitals NHS FT, via the trauma network, following a pedestrian versus car road traffic accident.

A crush injury to her pelvis and lower limbs was sustained after being struck from behind by a car at low speed while bending over into the boot of her own car. The patient, who was reaching into the boot of her parked car, was struck from behind by a car travelling at low speed, crushing her pelvis and lower limbs between the vehicles.

Up until this point, the patient's pregnancy had been uneventful and was progressing as expected.

There was no medical history of note other than a normal vaginal delivery 3 years previous.

Throughout initial assessment and transfer, the patient remained haemodynamically stable with a

Glasgow Coma Scale of 15. A pelvic binder was applied by paramedics.

On arrival to Addenbrookes, she was met by a full obstetric trauma team and assessed using advanced trauma life support principles.

Radiographs, taken with the pelvic binder off, revealed an open book pelvic fracture with a widely displaced (>5 cm) pubic symphysis (figure 1).

Focused assessment with sonography for trauma scan was negative, and revealed the fetus to be active and in a cephalic position, with a good fetal heart rate. The pelvic binder was immediately reapplied.

After discussion with the radiology team, it was felt the best imaging for further assessment in light of the patient's pregnancy, mechanism of injury and suspected pelvic fractures, was a CT scan with a single arterial phase.

CT revealed the pubic symphysis diastasis to be successfully reduced with the binder (figure 2A).

No further pelvic or sacral fractures or other intra-abdominal injuries were identified, making this an isolated anteroposterior type 2 (APC2) injury under the Young-Burgess classification.

The patient was transferred to the high dependency unit for on-going management. She was nursed in the left lateral (right side up) position at about 20° using a triangular foam wedge in accordance with ATLS guidelines to reduce compression of the IVC.

Following discussions between the orthopaedic pelvic and acetabular surgeon and obstetric team, it was felt that, while the patient remained haemodynamically stable, her pelvic fracture could be managed with external fixation. This would allow the baby to remain in utero ideally until at least

Figure 1 Regional trauma centre X-ray of open book anteroposterior type 2 (APC2) closed injury.

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Figure 2 Trauma CT imaging with contrast. (A) Three-dimensional reconstructed imaging.

34 weeks, to allow for fetal maturation. The patient was also discussed with haematology, given that she was at high risk for developing a venous thromboembolism while pregnant and immobile with a pelvic fracture.

It was advised to start low molecular weight heparin at a prophylactic dose.

The patient underwent application of a supra-acetabular ex-fix, using large (6.5 mm) hydroxyapatite-coated AO Schanz pins, to her pelvis. She received a general anaesthetic and was placed supine, in the left lateral tilt position, on a radiolucent 'Jackson' table. The preference was for supra-acetabular fixation. Using an obturator oblique outlet shot to verify entry point confirmation, a 3 cm skin incision was made just inferior to the anterior-inferior iliac spine. An obturator outlet and inlet shot were taken to line up the drill tip (4.5 mm) in the supra-acetabular zone, checking progress with an iliac oblique view to ensure passage through the appropriate corridor in the direction of the sacroiliac joint above the sciatic notch. A second pin was passed superior to this pin, at the junction of the supra-acetabular area and the ilium itself, to provide better security to the construct. Image intensifier was used sparingly to minimise radiation exposure. The total estimated fetal dose was 0.2 mGy. The "MRI compatible" bars for the ex-fix were placed with the apex distal and left sided to allow the patient to sit up and have appropriate nursing without interfering with the protruberance of the gravid uterus (figure 3A, B).

Postoperative recovery was unremarkable and the patient was able to be stepped down to the orthopaedic ward. An ex-fix spanner was provided to accompany the patient at all times in case of emergency lower (uterine) segment caesarean section

Figure 3 Imaging of supra-acetabular external fixator intraoperatively.

(LSCS) with need to adjust the ex-fix. She was non-weight bearing throughout.

At 34+3 weeks pregnancy, the patient was reviewed by the obstetric team and felt to be in premature labour.

An emergency LSCS was performed prior to which the ex-fix bars were adjusted by the orthopaedic team to allow adequate access to the lower abdomen.

The baby was born in good condition and, following the LSCS, the ex-fix was returned to its original positioning, with check X-ray.

Ten days postoperatively, the patient returned to theatre for washout and debridement of the ex-fix for a suspected pin site infection.

During this procedure, discharge was noted from the LCSC wound and a VAC dressing was applied. No deep collection was identified on ultrasound, so this was treated as a superficial wound infection.

Oral antibiotics were started and continued until removal of the ex-fix.

The patient continued to do well and her wounds and infection settled. The abdominal VAC dressing was discontinued 43 days after the ex-fix was applied and, 31 days after the LSCS, she returned to theatre for its removal. The pelvis was stressed in theatre under fluoroscopy after removal of the linked bars.

On stressing of the symphysis and the sacro-iliac joints, the symphysis opened approximately 2 cm, and although a slight opening at the left SIJ was noted, this was 'figure of 4' stable to stressing, axial and vertical traction. The decision was therefore

Figure 4 Post removal of external fixator. (A) Pelvis at rest and (B) stress view.

made to remove the ex-fix without the need for internal fixation (figure 4A, B).

Postoperative advice was to allow full weight bearing on the right, but to remain non-weight bearing on the left for a further 4 weeks, with follow-up in clinic.

OUTCOME AND FOLLOW-UP

Subsequent review in clinic at 4 weeks showed the patient to be recovering well with no symptoms of pelvic instability. All scars were clean and healthy.

Radiographs showed residual 2 cm symphyseal diastasis, although this remained within the normal limits of postpartum status. The patient resumed full weight bearing at 6 weeks post-delivery, and remains under orthopaedic review (figure 5).

DISCUSSION

Traumatic pelvic injuries are extremely rare in pregnancy and therefore evidence within the literature on how best to manage them is limited.

Figure 5 Anteroposterior pelvic X-ray from clinic, at 4 weeks.

They represent a unique challenge clinically as both mother and fetus need to be considered, although legally, the mother's well-being takes precedence.

Maternal mortality from major trauma is quoted to be around 10%, with fetal death rates being much higher.^{1 2}

Even if the fetus survives the initial trauma, it is still at risk of premature birth with its associated problems.

A review article in 2007³ retrospectively looked at 14 cases of pelvic fractures in pregnancy.

It found the majority were managed conservatively, with only three requiring surgical input.

Of these three, two underwent open reduction and internal fixation with only one resulting in survival of both mother and child.

In the third case, external fixation was used but the patient was multiply injured and, unfortunately, both mother and child died shortly after from other injuries.

A further review in 2013 suggests the potential use of external fixation to stabilise the pelvis when the fetus remains viable,^{1 2} although we have not identified any other cases in the literature where this technique has been used.

The case we describe illustrates how external fixation can be used successfully in the management of pelvic injuries in pregnancy (with benefit to both mother and fetus), with a view to subsequent controlled LSCS. This allows the fetus to remain in utero aiming to prevent the need for pre-term delivery and thus allowing vital fetal maturation.

Although open reduction and internal fixation of the pubic symphysis with plates and screws remain the gold standard for treating this pattern of injury, pelvic ex-fix provides a mechanism by which to stabilise the pelvis while limiting insult to the uterine environment and potentially reducing the risk of infection.

It also provides an option for definitive management of the pelvic fracture, as demonstrated by this case.

The supra-acetabular ex-fix can be adjusted to allow access for an LSCS and re-adjusted so that it can remain in place after the baby is delivered. Having stability of the anterior pelvis is important for delivery during LSCS, as the baby is carefully removed from the true pelvis.

The application of an ex-fix in comparison to open reduction internal fixation of the pubic symphysis requires less operative time and therefore limits the anaesthetic exposure to both mother and child. In addition, the overall radiation exposure is

Novel treatment (new drug/intervention; established drug/procedure in new situation)

likely to be much less. Using intraoperative summative radiation exposure data and PCXMC software, we estimate the fetal absorbed dose to be 0.2 mGy. This is much less to the deterministic threshold dose of 100 mGy for various effects, so there will be no risk of these occurring to the infant.⁴

In terms of stochastic effects, the increased risk of cancer occurring in the infant up to the age of 15 years due to the exposure will be approximately 1 in 65 000.⁴ This risk is much lower than the natural risk of childhood cancer in the UK, which is 1 in 500.⁴ Put in a slightly different way, the exposure will have increased the risk of childhood cancer by <1% relative to natural rates.

For an emergency resuscitative ex-fix, the Schanz pins can be placed in the iliac crests anterior to the gluteal tubercle or in a supra-acetabular position, in which the pins are placed slightly superior and lateral to the anterior inferior iliac spine.⁵

However, the usual lie of the third trimester uterus makes it very difficult to achieve a safe, effective and comfortable traditional iliac crest ex-fix. The direction of corrective force is in the wrong plane for an open book APC2 injury. In addition, it would not have utility as definitive management and would not mechanically aid the actual LSCS procedure. Careful consideration must be taken when positioning the patient to prevent the gravid uterus placing pressure on the inferior vena cava. A left lateral tilt must be utilised that closes the left sided window of appropriate angles for pin placement.

Placement of the pins must also be meticulously planned in order to safely construct a stable ex-fix without breaching the pelvic or uterine environment, both of which are highly vascular in the third trimester. Iliac crest pins have the potential to breach the inner table of the pelvis and, although technically easier to insert, are less stable than pins placed in the dense bone of the supra-acetabular region. Pins placed low in the SA region risk encroaching on the superior aspect of the hip capsule.

In this case, it was decided to place the pins in the supra-acetabular position. Pins in this position can be slightly more difficult to place than iliac crest pins, but this positioning makes it is easier to achieve good pin purchase with better longevity. It also allows a wider construct to be achieved allowing space for the gravid uterus and better access to the lower abdomen for when an LSCS is required. Hydroxyapatite-coated pins are favoured by the senior author as they appear to confer

better longevity of the pins and potentially reduce local soft tissue infection. Unfortunately, pin site infection is a common occurrence for ex-fix placed near the groin crease. Pin sites must be closely monitored and dressed, with any evidence of infection appropriately treated.

This case demonstrates that, when faced with an unstable pelvic injury in a pregnant patient, supra-acetabular external fixation provides an important option for management of both the mother and fetus.

Learning points

- ▶ There is limited guidance available for how best to manage pelvic fractures in pregnant patients, so each trauma scenario must be assessed on a case-by-case basis.
- ▶ An external fixator can be used to provide pelvic stability and allow the fetus to mature in utero.
- ▶ Careful operative planning and judicious use of intraoperative fluoroscopy is required when applying a pelvic supra-acetabular external fixator to the pregnant patient. Pins must be placed to provide a stable construct, without breaching the pelvic or uterine environment, and must allow safe access for subsequent LSCS.

Competing interests None declared.

Patient consent Obtained.

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