Birth Injuries

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35.1 Introduction

The majority of birth injuries are minor and often unreported. Occasionally, though, birth injuries may be so severe as to be fatal or leave the child with a permanent disability. They may occur because of inappropriate or deficient medical skills or attention, but they also can occur despite skilled and competent obstetrical care. Birth injuries are mostly iatrogenic, and the legal implications of these should be noted. Most of these injuries can be managed nonoperatively, but prompt identification of those that will need surgical intervention is essential.

35.2 Demographics

The incidence of significant birth injuries in the United Sates is 6–8 per 1000 live births, accounting for less than 2% of perinatal mortality [1]. In Africa, statistics on birth injuries are lacking. However, a survey of rural Egyptian birth attendants in different regions revealed an overall prevalence of birth injuries at 7% and up to 17% in the Aswan region [2]. Autopsy studies on stillbirths from Accra, Ghana, also estimate the incidence of perinatal deaths due to birth trauma as 5.4% [3].

35.3 Aetiology

The risk factors for birth injuries are as follows [4–6]:

1. Primigravida
2. Maternal age younger than 16 or older than 35 years
3. High neonatal birth weight
4. Maternal parity >6
5. Prolonged or precipitate delivery
6. Cephalopelvic disproportion
7. Fetal presentation (face, breech)
8. Type of delivery (forceps, vacuum)
9. Prematurity
10. Postmaturity
11. Organomegaly and mass lesions in the abdomen
12. Coagulopathy

Injuries are sustained as a result of mechanical impact on the foetus during birth due to pressure in the birth canal or to traction and pressure produced by manipulations during delivery. The risk of injury to infants during breech delivery is about twice that with vertex delivery. Birth injuries can also occur, however, in spontaneous, full-term, apparently uncomplicated deliveries.

35.4 Clinical Presentation and Management

35.4.1 Fractures

Most fractures following birth trauma heal spontaneously. Nonunion is almost unknown. The most common bones involved are the clavicle, femur, humerus, and skull. Calcification of these fractures is evident by the second week of life. The absence of such calcifications suggests child abuse rather than birth injury, especially if the bones involved are those other than the ones commonly affected in birth injuries. Dislocations following birth trauma are generally rare.

35.4.1.1 Clavicle

The clavicle is the most common fracture in the newborn, following from difficulty with delivery caused by shoulder dystocia [7]. Many times, the fracture is noticed only when callous formation begins. It is usually a green stick fracture and occasionally is associated with brachial plexus injury. Fracture of the clavicle requires no treatment.

35.4.1.2 Long Bones

Fracture involving the long bones is not common. The femur may be involved during a difficult breech delivery when traction is applied to extract the foetus and usually the midshaft is involved [8]. This fracture is treated by skin traction or splinting with a spica cast. Fracture of the humerus is encountered during a difficult delivery of the shoulder in a vertex presentation. Humeral fractures may be associated with Erb's or radial nerve palsy. These fractures are treated by restricting the baby's movements by bandaging the arm to the chest for a period of 1–3 weeks.

35.4.1.3 Skull

Linear fracture, especially of the parietal bone, is the most common injury seen; it needs no treatment. Depressed skull fractures may require elevation, depending on severity. Closed elevation of a so-called "ping-pong" fracture can be achieved by the use of the vacuum extractor. Open elevation will be required if there is increased intracranial pressure, neurological deficit, or when bony fragments are projecting into cerebral tissue.

35.4.1.4 Cephalhaematoma

Cephalhaematoma is a subperiosteal haemorrhage, which is limited to one cranial bone by surrounding cranial sutures (◘ Fig. 35.1). It appears on the second day

Fig. 35.1 The rare occipital cephalhaematoma in an infant

of life and is important to distinguish from caput succedaneum which is comprised of oedema and often crosses suture lines. There may be a linear fracture of the underlying bone. Most cephalhaematomas are resorbed within 2 weeks to 3 months of age. A massive cephalhaematoma may require blood transfusion. Aspiration or incision of the swelling is contraindicated. Calcification of the haematoma may require surgical excision.

35.4.2 Neurological Injuries

35.4.2.1 Brachial Plexus

The most common neurological injury is brachial plexus injury. These injuries often occur after difficult labour with shoulder dystocia or breech presentation, which are more common with larger infants. The predominance of the right plexus injury is related to the common left occipito-anterior presentation that leaves the right shoulder against the pubic arch. Erb-Duchenne paralysis results if the upper roots (C5, C6) are involved. The arm appears adducted and internally rotated, and the forearm is pronated. The Moro reflex on the ipsilateral side is also absent. The hand muscles function normally and there is no sensory deficit. The phrenic nerve is involved in 5% of cases and should always be ruled out.

In the Déjerine-Klumpke palsy, the lower part of the brachial plexus (C8, T1) is involved, causing wrist drop with associated paralysis of the hand. Horner's syndrome is frequently associated with this injury. This has a worse prognosis than Erb-Duchenne paralysis.

Patients are followed up closely with both active and passive exercises. Most patients make a complete recovery with this conservative management. Persistence of deficit for 3 months is an indication for surgical intervention, but this is rare.

Neurolysis, end-to-end anastomosis, and nerve grafting are some of the surgical procedures employed. Primary surgery for brachial plexus lesions with modern microsurgical techniques is an emerging surgical option, with the prospect of improving functional recovery in carefully selected patients who would otherwise be faced with lifelong impairment and secondary skeletal deformities. Grafting and extraplexal neurotisation are the procedures most commonly involved. Donor nerves include the intercostal nerves, phrenic nerve, spinal accessory nerve, and contralateral C7 root [9, 10].

35.4.2.2 Facial Nerve

Facial nerve injury may follow forceps delivery for face presentation or may arise from pressure from the birth canal during labour. Facial nerve injury is of the lower motor neurone lesion in most cases; it usually recovers with nonoperative treatment. In facial nerve paralysis, care of the exposed cornea is important. This is done by instillation of methylcellulose eye-drops into the conjunctival sac [11].

35.4.2.3 Phrenic Nerve

The phrenic nerve is rarely involved; this nerve affects diaphragmatic function. It needs to be differentiated from congenital diaphragmatic hernia or eventration of the diaphragm. Chest infections are a serious complication of this injury. Spontaneous recovery is expected in 1–3 months. After 3 months without recovery, operative intervention is indicated. Imbrication or prosthetic replacement of the diaphragm is usually carried out [12].

35.4.2.4 Spinal Cord

Spinal cord injury is one of the most devastating injuries because in the very severe cases, the babies may be stillborn or die in the immediate postnatal period. The infants who survive with spinal injury may have permanent neurological abnormalities due to the damage to the spinal cord or the vertebral arteries [13]. The mechanism of injury to the spinal cord involves application of strong traction when the spine is hyperextended or when the direction of pull is lateral. It may also occur with a

forceful longitudinal pull when the head is firmly engaged. The most common part of the spinal cord involved is the upper cervical C4 with cephalic presentation. Affectation of vertebra above C4 is usually fatal due to compromised respiration because the vital centres in the upper cervical cord and brain stem may be involved [12]. In addition, lower cervical cord injuries (C5–C7) may occur with breech deliveries. Haemorrhage or oedema may result in cord compression, manifested by neurological signs. Plain radiography is not very helpful because cord transection can occur without vertebral fractures. Ultrasonography (US) and magnetic resonance imaging (MRI) are best to characterise the site and extent of injuries and are usually confirmatory.

The mainstay of treatment is supportive, with physiotherapy, urology, orthopaedics, and psychology involved. This supportive treatment may mean endotracheal intubation for artificial respiration in the upper cervical injury group. Therefore, great emphasis is placed on prevention.

35.4.2.5 Intracranial Trauma

This trauma is usually intracranial haemorrhage and can be subdural, subarachnoid, or intracerebral. Intracranial trauma usually follows vacuum extraction of the foetus [11].

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Subdural Haemorrhage

Acute subdural haemorrhage is a recognised cause of increased head circumference and anaemia soon after birth [14]. The haemorrhage is from dural sinuses or the major cerebral veins. The clinical features are those of a focal neurological deficit, hemiparesis, unequal pupils, or deviation of the eyes. Other symptoms include bulging anterior fontanelle, pallor, vomiting, irritability, and seizures. The diagnosis is suggested by a subdural tap. Computed tomography (CT) scan and MRI are required to confirm the diagnosis. The treatment is by repeated tap of the subdural space by using a size 20G needle to relieve intracranial pressure.

Subarachnoid Haemorrhage

Subarachnoid haemorrhage results from damage to the veins traversing the subarachnoid space. It is the most common form of intracranial haemorrhage related to the trauma of birth. Subarachnoid haemorrhage is suspected on lumbar puncture with frank blood or a tinge of blood. There is no treatment required, as it resolves spontaneously.

Intracerebral Haemorrhage

Intracerebral haemorrhage is the least common intracranial trauma. The clinical presentation is that of increased intracranial pressure. Serial US, CT, and MRI are needed to monitor the regression.

35.4.3 Solid Abdominal Visceral Injuries

Solid abdominal visceral injuries are the most serious complications of birth trauma, but, fortunately, they are comparatively rare [15]. The liver is the most common organ involved, followed by the adrenal gland, spleen, and kidney, in that order. The presenting symptoms are severe shock and abdominal distention. However, these patients may appear normal for the first 3 days. Therefore, a high index of suspicion is required to make an early diagnosis. Refusal of feeds, listlessness, and rapid respiration in the presence of a rapidly developing anaemia should alert the physician to the possibility of internal bleeding. The presence of scrotal haematoma is an indication of haemoperitoneum usually in a patient with persistence of the processus vaginalis. Abdominal paracentesis will confirm haemoperitoneum. Abdominal ultrasound will confirm the injury and is also used in monitoring patients where nonoperative treatment is used. Coagulopathy and hypoxia are contributing factors to injuries.

35.4.3.1 Liver

One mechanism of injury to the liver is thoracic compression pushing the liver down and applying a pull on the hepatic ligaments, leading to a tear of these ligaments at their site of attachment [16]. Another is direct pressure on the liver during the passage of the foetus through the maternal pelvis, leading to subcapsular haemorrhage [16]. In breech delivery, blood is compressed from the lower parts of the body, and venous return is retarded by the compression on the chest by the uterus, leading to marked congestion of the solid abdominal organs. Therefore, if pressure is applied on the trunk instead of the pelvis during delivery, any of these organs may be injured. This is the most common form of hepatic injury encountered—even more so in the premature baby whose liver is more exposed.

The nonoperative approach to correction of liver injury should be considered, as described in ▶ Chap. 29 on abdominal injuries. In severe cases, particularly in haemodynamically unstable infants, surgical exploration should be undertaken. Topical haemostatic agents such as fibrin glue are more effective than direct suturing or electrocoagulation of the involved liver surface [17]. In Africa, where these agents may not be available, however, the use of the omentum, which acts as a plug when sutured in place, is advocated.

35.4.3.2 Adrenal Gland

The right adrenal gland is most commonly involved in birth injuries. The vertebra exposes it to mechanical compression. The presence of a neuroblastoma is a risk factor that must always be ruled out in adrenal trauma [18]. Plain abdominal X-ray will show a rim of

calcification only in adrenal haemorrhage, as different from the diffuse calcification seen in the diagnosis of the tumour. Biopsy of the adrenal gland should always be taken at laparotomy in suspicious cases.

In bilateral injuries involving the adrenal gland, acute adrenal insufficiency characterised by pyrexia, convulsions, coma, hypoglycaemia, and hyponatremia are additional forms of presentation. In fact, in the more severe cases of bilateral adrenal haemorrhage, the diagnosis is usually made at postmortem examination. Patients should be resuscitated from shock and steroid replacement, and electrolytes should be administered in cases with adrenal involvement. Coagulopathy should be corrected.

Nonoperative treatment suffices in most cases of adrenal injuries. Haemorrhage into the perinephric fascia arrests spontaneously. Unilateral adrenalectomy is well tolerated if needed, although steroid replacement may be necessary.

35.4.3.3 Spleen

Injury to the spleen secondary to birth trauma is rare. The mechanism of injury and clinical presentation are similar to those for the liver. The injury can occur alone but is frequently associated with liver injury. Preservation of the spleen is a high priority to avoid the problem of overwhelming postsplenectomy infection [19]. However, spleen-sparing surgeries are very difficult in the newborn, and splenectomy is frequently carried out.

35.4.3.4 Kidney

The kidney is rarely involved in birth injuries. Tissue preservation, just as for the spleen, is paramount. Intravenous urography is indicated to assess the extent of renal injuries. CT scan is the modality of choice in more accurate assessment of these injuries.

35.4.4 Genitourinary Injuries

Fetal manipulations in breech delivery have been associated with scrotal and testicular injuries in boys. In one particular report, an iatrogenic injury caused castration in a newborn [20].

In girls, severe perineal tears have been described following both breech delivery and caesarian section (Fig. 35.2). These injuries require prompt surgical intervention by way of a multilayered closure to achieve a good outcome [21]. A significant delay was associated with a fatal outcome from overwhelming sepsis [22].

Fig. 35.2 A severe form of perineal injury from repeated vaginal examination from the referral hospital. The child was delivered by a caesarian section due to delayed second stage and breech presentation

35.4.5 Rare (Unusual) Injuries

Injuries to the pharynx, trachea, bronchi, or oesophagus have been described following the use of suction or endotracheal tubes [1]. Dislocation of the triangular cartilage of the nasal septum has been described [23]. Evisceration of the bowel through a wide tear of the umbilical cord during delivery may occur. This may result in bowel injury, requiring resection and anastomosis. If this occurs immediately after birth, it can be confused with gastroschisis by the inexperienced birth attendant [24].

35.5 Prevention

In developed countries, improvements in obstetrics care, particularly antenatal ultrasonography, have allowed identification of risk factors for birth trauma and have led to modification in modes of delivery [25]. Also, more liberal use of caesarian section, decreased use of difficult forceps delivery, and centralisation of high-risk services have reduced the incidence of birth trauma. In developing countries, however, many deliveries still take place outside the orthodox centres. This practice is attended by a higher incidence of birth injuries and increased perinatal mortality [2, 3, 26].

Health education and training of traditional birth attendants and reduction of delivery fees in hospitals in Africa will reduce the perinatal morbidity and mortality associated with birth injuries.

35.6 Evidence-Based Research

Table 35.1 presents a case-control study of the incidence of birth trauma using a 5-year review [27].

Table 35.1 Evidence-based research

Title	Birth trauma. A 5-year review of incidence and associated perinatal factors
Authors	Perlow JH, Wigton T, Hart J, Strassner HT, Nageotte MP, Wolk BM
Institution	Department of Obstetrics and Gynecology, Christ Hospital and Medical Center, Oak Lawn, Illinois, USA
Reference	J Reprod Med 1996;41(10):754–760
Problem	Birth injury
Intervention	Case-control study
Comparison/control (quality of evidence)	Compares cases with injury to control births without injury to examine the incidence of clavicular fracture, facial nerve injury, and brachial plexus injury at birth to identify possible risk factors
Outcome/effect	The injuries are associated with prolonged gestation, epidural anaesthesia, prolonged second stage of labour, oxytocin use, forceps delivery, shoulder dystocia, macrosomia, low Apgar scores, and a previous maternal obstetric history of macrosomia when compared to controls. Other significantly associated variables include the presence of meconium in labour and neonatal hyperbilirubinaemia. Despite the presence of multiple perinatal factors that are individually associated statistically with the injured groups, multiple logistic regression analysis predicted 44.2% of clavicle fractures, none of the facial nerve injuries, and only 19% of the brachial plexus injuries
Historical Significance/comments	Most reports of birth injuries are case studies; this study, however, tries to examine for risk factors

Key Summary Points

1. The majority of birth injuries are minor.
2. Breech delivery is a major risk factor for birth injuries.
3. Fractures from birth injury heal spontaneously; nonunion is almost nonexistent. The clavicle is the most common bone fractured.
4. Brachial plexus injuries are the most common form of neurological injury. The majority (75%) will recover with conservative management.
5. Spinal injuries are rare, but severe, with a fatal outcome or survival with a permanent disability.
6. Solid abdominal visceral injuries, although rare, have the most serious complications of birth trauma.
7. The liver is the most common organ involved. A high index of suspicion is necessary for the diagnosis of these injuries.
8. The presence of a tumour should be ruled out when the adrenal gland is involved.
9. In girls, severe perineal tears have been described; these require prompt surgical intervention to avoid a fatal outcome.
10. Antenatal ultrasonography should be employed to identify risk factors for birth trauma and modify modes of delivery.
11. In Africa, health educations, training of traditional birth attendants, and reduction of delivery fees should encourage more women to have supervised antenatal care and delivery and hence reduce the risk of birth injuries.

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